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USSR AND EASTERN EUROPE SCIENTIFIC ABSTRACTS

GEOPHYSICS, ASTRONOMY AND SPACE

No. 398

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I. ASTRONOMY

News

MONOGRAPH ON ENERGETIC ASPECTS OF SOLAR-TERRESTRIAL RELATIONSHIPS

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian
No 1, 1977 1.51.407

[Abstract of monograph by I. V. Kovalevskiy; Moscow, ENERGETICHESKIYE ASPEKTY SOLNECHNOZEMNYKH SVYAZEY (Energetic Aspects of Solar-Terrestrial Relationships), "Nauka," 1976, 52 pages]

[Text] This monograph contains the following chapters: Sun as a Source of Energy; Interplanetary Medium; Results of Interaction Between the Interplanetary Medium and the Earth's Magnetic Field; Energy Fluxes of the Interplanetary Medium at a Distance of 1 a.u.; Energy Incident on the Magnetosphere; Energy Parameters of Magnetic Storms; Mechanisms of Energy Transfer Within the Magnetosphere; Energy of the Geomagnetosphere; Energy Exchange and Energy Dissipation of the Magnetosphere.
[40]

BOOK ON PHYSICS OF SOLAR ACTIVITY

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian
No 1, 1977 1.51.84K

[Abstract of monograph, unsigned; Moscow, FIZIKA SOLNECHNOY AKTIVNOSTI, Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation, "Nauka," 1976, 2151 pages]

[Text] This volume contains the results of investigations in the optical and radio ranges for determining the dynamics of solar flares and some characteristic properties of phenomena in active regions on the sun associated with the structure of magnetic fields. The basic original observations

which are used in the analysis were obtained in the Division of Solar Physics of IZMIRAN (Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation) and from observational data on the solar eclipse of 1973 obtained by an expedition of the Slovakian Academy of Sciences (Czechoslovakia).

[40]

Abstracts of Scientific Articles

DAILY MAPS OF THE SUN AND GEOPHYSICAL GRAPHS

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian No 1, 1977 1.51.402

[Abstract of periodical; Moscow, SOLNECHNYYE DANNYYE, No 6, 1976, pp 1-44]

[Text] For June 1976 regular data are published on solar activity on the basis of observations at observatories in the USSR, CzSSR, Rumania, East Germany and the Republic of Cuba. In addition, information is given on the state of the earth's magnetic field on the basis of data from magnetic observatories in the USSR.

[40]

MAGNETIC FIELDS OF SUNSPOTS IN APRIL 1976

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian No 1, 1977 1.51.403

[Abstract of appendix to periodical; Leningrad, PRIL. K. BYUL. No 4, SOLNECHNYYE DANNYYE, 1976, USSR Academy of Sciences, Astronomical Council, Main Astronomical Observatory, "Nauka," 1976, 16 pages]

[Text] The periodical appendix contains detailed maps of magnetic fields of sunspots on the basis of data from observatories in the Soviet Union.

[40]

HYDRODYNAMIC PROCESSES IN ATMOSPHERES OF LARGE PLANETS

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian No 1, 1977 1.51.240

[Abstract of article by B. S. Keller and I. M. Yavorskaya; Moscow, AEROMEKHANIKA I GAZ. DINAMIKA, "Nauka," 1976, pp 256-259, "Modeling of Hydrodynamic Processes in the Atmospheres of Large Planets"]

[Text] The authors propose a model of the hydrodynamic processes developing in the lower layers of the atmospheres of large planets under the influence of an internal heat source and solar radiation. With a definite choice of parameters the model makes it possible to explain the apparent banded structure of the surface and some peculiarities of differential rotation and give an estimate of the depth of the Jovian atmosphere. Bibliography of 38 items.

[40]

MAP OF DIELECTRIC CONSTANT OF MARTIAN SURFACE LAYER

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian No 1, 1977 1.51.246

[Abstract of article by N. N. Krupenio; Moscow, KARTA DIELEKTRICHESKOY PRONITSAYEMOSTI VESHCHESIVA POVERKHNOSTNOGO SLOYA MARSA (Map of the Dielectric Constant of the Surface Layer of the Martian Surface), Space Research Institute USSR Academy of Sciences, Preprint Pr-275, 1976, 11 pages]

[Text] The map was compiled using data from radiophysical investigations of Mars carried out from aboard the automatic interplanetary stations Mars-3 and Mars-5 at a wavelength $\lambda_0 = 3.4$ cm and using data from ground radar measurements of 1965-1971 carried out at $\lambda_0 = 3.8$ and 12.5 cm. The minimum linear resolution over the surface is 70 km. The map was compiled for five gradations of the dielectric constant: ~ 2.1 , 2.1-2.7, 2.7-3.4, 3.4-4.2 and > 4.2 , which corresponds to the following gradations of the evaluation of ground density: ~ 0.9 , 0.9-1.3, 1.3-1.7, 1.7-2.1, > 2.1 g/cm³. Data on the dielectric constant are related to the upper layer of Martian ground with an average thickness up to 2 m.

[40]

DECAMETER RADIOEMISSION OF JUPITER

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian No 1, 1977 1.51.274

[Abstract of article by B. M. Vladimirovskiy and L. S. Levitskiy; --, IZV. KRYM. ASTROFIZ. OBSERV., 55, 1976, pp 81-84, "Solar Activity and the Decameter Radioemission of Jupiter"]

[Text] On the basis of an analysis of the temporal variations of the indices of decameter radioemission of Jupiter obtained on the basis of data from observations at Boulder (1960-1971) it follows that the probability of the occurrence of radioemission is dependent on the declination of the earth in the Jovian coordinate system. Since the emission is observed only from

regions of the northern hemisphere of the planet, the presence of this dependence leads to an apparent anticorrelation of the probability of registry of radioemission and solar activity. The intensity of radioemission exhibits a positive correlation with solar activity. Bibliography of 18 items. [40]

MAGNETIZATION OF OLIVINE INCLUSIONS IN PALLASITE

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian No 1, 1977 1.51.340

[Abstract of article by Ye. G. Gus'kova and V. D. Kolomenskiy; Kiev, PROBLEMY KOSMOKHIMII, No 2, "Nauk. Dumka," 1975, pp 136-140, "Magnetization of Olivine Inclusions in the Finmarken Pallasite"]

[Text] The authors measured the natural remanent magnetization, magnetic susceptibility and density for 34 samples of olivine from the Finmarken pallasite. The interrelationship of these parameters and the stability of magnetization are determined by inclusions of magnetic minerals of both primary and secondary, that is, terrestrial, origin. Such investigations can yield new information on the conditions for formation of pallasites.

[40]

METHANE AND AMMONIA CONTENT IN THE ATMOSPHERE OF SATURN

Moscow PIS'MA V ASTRONOMICHESKIY ZHURNAL in Russian Vol 2, No 12, 1976, pp 584-588

[Article by V. G. Teyfel', Astrophysical Institute Kazakh Academy of Sciences, "Methane and Ammonia Content in the Saturnian Atmosphere"]

[Abstract] The author has obtained estimates of the equivalent thickness of CH_4 in the atmosphere above the clouds on Saturn and the equivalent absorption path for CH_4 and NH_3 per mean length and unit length of the free scattering path within the Saturnian cloud layer on the basis of an interpretation of observational data by computations for a two-layer model of the formation of absorption lines and bands. For determining the parameters of the two-layer model the author used the results of photoelectric measurements of the intensities of the CH_4 absorption bands 6190 Å and 7250 Å in the equatorial and southern temperate zones of Saturn. Quantitative estimates are presented.

[255]

HIGH-LATITUDE FLARES ON SUN AND PROTON FLARES

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian
No 1, 1977 1.51.379

[Abstract of article by Ye. F. Shaposhnikova; --, IZV. KRYM. ASTROFIZ. OBSERV., 55, 1976, pp 49-50, "High-Latitude Flares on the Sun and Their Possible Relation to Proton Flares"]

[Text] A study of high-latitude flares observed during the IGY period leads to the assumption that a possible reason for the appearance of such flares is the effect of a shock wave arising during the flaring up of proton flares in the activity zone. Bibliography of six items.

[40]

METER POLARIZED SOLAR RADIOEMISSION IN NOISE STORMS

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian
No 1, 1977 1.51.38

[Abstract of article by A. A. Gnezdilov; Moscow, SOLNECHNYYE DANNYYE, No 5, 1976, pp 94-99, "Some Peculiarities of Meter Polarized Solar Radioemission in Fluctuations of Noise Storms"]

[Text] On the basis of data from measurements with IZMIRAN radiopolarimeters (204 and 74 MHz) a study was made of the properties of fluctuations of the continual component of noise storms in the meter range with a time scale of several minutes. It was established that for completely polarized noise storms the intensity fluctuations are not accompanied by changes in the degree of polarization. At the same time, in the makeup of moderately or weakly polarized noise storms there is an intensity fluctuation of both left- and right-polarized components. These changes are in phase with one another. These peculiarities are attributable to the bipolar or multipolar structure of sources of noise storms, in which each source is completely polarized and fluctuates in intensity. Bibliography of 10 items.

[40]

SPECTRAL INDEX OF TWO LOCAL RADIOSOURCES ON SUN

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian
No 1, 1977 1.51.393

[Abstract of article by A. F. Bachurin, A. S. Dvoryashin and N. N. Yeryushev; --, IZV. KRYM. ASTROFIZ. OBSERV., 55, 1976, pp 70-73, "Spectral Index of Two Local Radiosources on Sun in the Short-Wave Part of the Centimeter Range"]

[Text] A study was made of the spectral indices for two local sources on the sun in the wavelength ranges 3.5-2.5 and 2.5-1.9 cm. The values of the spectral indices for the local source associated with a little-active spot group are appreciably greater than the corresponding values for a more active group. With an increase in the flare activity of the latter group and the appearance of powerful radio bursts in it the values of the spectral indices in the indicated wavelength intervals decrease significantly; the spectral index in the range 3.5-2.5 cm can assume negative values. This means that the maximum of the spectrum of a local source is displaced in the direction of short waves with an increase in group activity.

[40]

ASYMMETRY OF EMISSION LINES IN LIMB FLARES

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian No 1, 1977 1.51.376

[Abstract of article by A. N. Koval'; --. IZV. KRYM. ASTROFIZ. OBSERV., 55, 1976, pp 42-48, "Nature of the Asymmetry of Emission Lines in Some Limb Flares"]

[Text] A detailed study was made of the asymmetry of emission in the H_{α} line at different development stages in two limb flares observed on 23 June 1971 at the Crimean Astrophysical Observatory. The pattern of asymmetry in the first flare is as follows: in the very initial period the emission of the flare in the H_{α} line is symmetric, but in general is displaced in the red direction. Then blue asymmetry is observed. Red asymmetry was observed in a later stage in flare development. In the second flare, the first spectrograms of which were obtained near the maximum, only a red asymmetry was noted. In both flares there was a separation of the emission of the blue and red wings perpendicular to the direction of the dispersion in the stage of flare extinction. In the considered flares the asymmetry was caused by the superposing of a weaker extensive unilateral emission onto the flare emission. Bibliography of 11 items.

[40]

PHYSICAL PARAMETERS IN SOLAR POLAR REGIONS

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian No 1, 1977 1.51.367

[Abstract of article by A. N. Babin, S. I. Gopasyuk, V. A. Yefanov, V. A. Kotov, I. G. Moiseyev, N. S. Nesterov and T. T. Tsap; --, IZV. KRYM. ASTROFIZ. OBSERV., 55, 1976, pp 3-13, "Intensification of Magnetic Fields, Radio Brightness in the Millimeter Wavelength Region and H_{α} -Activity in Solar Polar Regions"]

[Text] During August-October 1974 specialists at the Crimean Astrophysical Observatory carried out parallel observations of longitudinal magnetic fields, radioemission at wavelengths of 8 and 13.5 mm and the chromosphere in the H_{α} line in the polar regions of the sun. The magnetic field measurements were made in the line Fe I $\lambda 5250$ using the magnetograph of the modernized tower solar telescope, radioemission observations were made using the 22-m radiotelescope, observations in the H_{α} line, using a coronagraph with an interference filter. It was discovered that in the polar regions, especially in the northern hemisphere, in the course of the observation period there was: 1) an increase in magnetic field strength (in some elements up to a hundred gauss), 2) an increase in radiobrightness, exceeding the emission level of the undisturbed sun on the average by 2000°K at a wavelength of 13.5 mm and by 1,500°K at a wavelength of 8 mm and 3) an increase in activity in the form of a flare and surges. Bibliography of 15 items.

[40]

BEHAVIOR OF MAGNETIC FIELDS IN ACTIVE REGIONS

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian No 1, 1977 1.51.368

[Abstract of article by Dzh. I. Irgashev; --, IZV. KRYM. ASTROFIZ. OBSERV., 55, 1976, pp 51-59, "Correlation Between Movements with Magnetic Fields in Active Regions"]

[Text] On the basis of observations carried out in the line Fe I $\lambda 5250$ on the magnetograph of the tower solar telescope of the Crimean Astrophysical Observatory the following conclusions were drawn. In active regions there are angles of predominant orientation of the gradients of radial velocities (in the picture plane) relative to the gradients of the longitudinal magnetic field. This indicates a definite organization of movements of matter by the magnetic fields of active regions. The maximum radial velocities in "hills" with gas movements directed toward the observer and away from the observer for the most part lie outside the maximum strengths in the "hills" of the longitudinal magnetic field and coincide on the average with the zero line of the longitudinal magnetic field. These peculiarities are characteristic for active regions observed both near the central meridian and at the limb of the solar disk. The observational data evidently indicate that the structural peculiarities (hills, zero lines) of the velocity field of an active region are for the most part determined by movements of the magnetic field together with matter. Bibliography of 22 items.

[40]

MAGNETIC FIELDS AND SUNSPOT MOTION

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian No 1, 1977 1.51.369

[Abstract of article by B. Kalman; --, IZV. KRYM. ASTROFIZ. OBSERV., 55, 1976, pp 60-69, Magnetic Fields and Characteristic Motions of Sunspots"]

[Text] On the basis of daily maps of the longitudinal and transverse components of the magnetic field, obtained at the Crimean Astrophysical Observatory and photographs of the sun taken at the Heliophysical Observatory at Debrecen (Hungary) it was possible to carry out a comparison of the motion of nuclei and filaments of the penumbra with the structure of the transverse magnetic field in a sunspot group during the period from 7 through 14 June 1969. It was found that the spots moved both along and across the direction of the transverse magnetic field. In the course of movement of the spots there were changes in the structure of H_{α} , in most cases corresponding to reorientation of the lines of force along the trajectory behind a moving spot. However, in some cases behind a moving spot the structure of the transverse field became close to perpendicular to the trajectory of a passing spot, although in front of the spot it could be almost parallel to the trajectory. The best coincidence of orientations of spot trajectories with the H_{α} structure was obtained near the zero line of the longitudinal field, that is, in those places where the magnetic field is close to purely transverse. There was a good correspondence between orientation of filaments of the penumbra along H_{α} when the group was near the central meridian. The correspondence deteriorated with increasing distance to the group from the central meridian. Bibliography of 19 items.

[40]

CHANGE IN PHYSICAL CONDITIONS IN FLOCCULI

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian No 1, 1977 1.51.374

[Abstract of article by E. A. Baranovskiy and N. N. Stepanyan; --, IZV. KRYM. ASTROFIZ. OBSERV., 55, 1976, pp 14-26, "Change in Physical Conditions in Flocculi and Their Development"]

[Text] The authors obtained the spectra of about 300 nodes of flocculi in different stages of development. It was possible to construct profiles of the H Ca II line and find the ratio of the central residual intensities of the H and H_{α} lines. These ratios and profiles of the H line are compared with the corresponding computed values for a large number of floccular models. For computing the profiles the authors jointly solved the transfer and stationary state equations for incoherent scattering. As a result of

the comparison the authors selected a series of models corresponding to flocculi of increasing brightness. Determination of the physical parameters on the basis of these models and observations of flocculi made it possible to draw the following conclusions. A flocculus is a layer of increased density at the altitude of formation of the H₃ line (1,700 km). For individual nodes the density values are in the range $10.7 > \lg n_H > 12.6$. In this region the flocculus is hotter than the surrounding chromosphere by a value up to 2,000°K. In the lower-lying layers the temperature increased, but the density was not increased in comparison with the undisturbed chromosphere. The brighter the flocculus, the denser and hotter it is and the deeper the atmosphere is heated beneath it. The developing flocculi are hotter than the old flocculi in the region H₂ and in the photosphere with an identical brightness in H₃. Among the old flocculi 75% of the nodes exhibit convergence of the layers at the levels H₃ and H₂, among the developing flocculi -- only 50%. Rotating focculi were investigated. Their dimensions are 10,000-30,000 km. They are hotter and extend to a lesser depth than ordinary flocculi of this same size. Bibliography of 25 items.

[40]

DETERMINING MOST PROBABLE FIGURE OF VISIBLE SOLAR DISK

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian No 1, 1977 1.51.181

[Abstract of article by I. G. Kolchinskiy, A. V. Arkhangel'skiy and V. V. Kirichuk; --, GEOD., KARTOGR. I AEROFOTOS"YEMKA. RESP. MEZHVED. NAUCH.-TEKHN. SB., No 24, 1976, pp 30-36, "Plotting of the Most Probable Figure of the Visible Solar Disk from its Photoimage"]

[Text] The use of photoimages of the sun for determining astronomical refraction (see RefZh Astr., 1975, 7.51.179) and its anomalies requires solution of two problems: choice of the curve best corresponding to the apparent form of the photoimage of the solar disk and orientation of the solar photoimage on a measuring instrument relative to its coordinate axes. An analytical study was made of the refraction deformation of the visible solar disk with $z \geq 80^\circ$ and formulas are given for computing the difference in solar semi-diameters. It is shown that the figure obtained when photographing the solar disk is not an ellipse, but constitutes two different curves with a smooth transition into one another. The authors propose an instrumental method for orienting the solar image on the measuring instrument. Bibliography of eight items.

[40]

NEW MODEL OF THE CHROMOSPHERE AND TRANSITION LAYER

Moscow REFERATIVNYY ZHURNAL 51. ASTRONOMIYA, OTDEL'NYY VYPUSK in Russian No 1, 1977 1.51.351

[Abstract of article by E. Ye. Dubov; --, IZV. KRYM. ASTROFIZ. OBSERV., 55, 1976, pp 27-36, "Further Development of a Model of the Chromosphere and Transition Layer"]

[Text] A study was made of the relationship between fibrils and supergranules and the probable profile of the $H\alpha$ line for fibrils and filigree formations. It is shown that the transition layer from the chromosphere to the corona is thick over both the boundaries and over the middle of the supergranules. The article proposes an approximate model of a refined picture (in comparison with the model proposed earlier by the author) of the chromosphere and transition zone from the chromosphere to the corona. The gas pressure in the transition layer is less than in the corona. Due to the increase in the thickness of the transition zone in the new model, in contrast to the preceding one, the emission in lines of the far UV region is greater over the boundaries than over the middle of the supergranules. Bibliography of 21 items.

[40]

ROLE OF RADIATION IN MOTION OF HIGH-VELOCITY METEORS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 231, No 5, 1976 pp 1084-1087

[Article by I. V. Nemchinov, T. I. Orlova, V. V. Svetsov and V. V. Shuvalov, Institute of Physics of the Earth, "Role of Radiation During Atmospheric Motion of Meteors at Very Great Velocities"]

[Abstract] Many studies have been made of the radiation-gas-dynamical processes transpiring during flow around bodies moving in the atmosphere at great velocities, but these deal for the most part with velocities up to 11-16 km/sec at which radiation still does not fundamentally change the nature of flow. However, it is known that meteors can enter the atmosphere at far greater velocities -- up to 50-70 km/sec. It is for the latter velocities which the authors compute the parameters characterizing the role played by radiation. The calculations presented here show that during the motion of quite large meteor bodies at very great velocities regimes arise which can be called radiation regimes in which the processes of intensive evaporation are determined by radiation and thick heated regions are formed in front of the shock wave front, that is, the general picture of flow around the body is changed.

[292]

II. METEOROLOGY

News

SCIENTIFIC COUNCIL ON PROBLEMS OF WEATHER FORECASTING HELD

Moscow PRAVDA in Russian 15 Apr 77 p 2

[Unsigned article: "The Weather Service: A Firm Base"]

[Text] Why are there errors in long-range weather forecasts? What sort of objective and subjective factors cause these errors? These questions were asked in the commentary "Winter Comes From the Equator" (PRAVDA, 30 December 1976). The Director of the USSR Hydrometeorological Scientific Research Center, M. Petrosyants, and the secretary of the Party bureau, Yu. Pashkov, report: The quality of weather forecasts is correctly evaluated in the article and some other shortcomings in the forecasting work of the USSR Hydrometeorological Center are mentioned. Above all, this applies to monthly weather forecasts. Actually, their quality does not meet the needs of users. At the present time they cannot serve as a reliable basis for making critical economic decisions. The problems raised in the article were discussed at an open Party Bureau meeting. A special session of the scientific council was held at the USSR Hydrometeorological Center at which 12 reports on the status of work and the prospects for monthly weather forecasts were heard and discussed.

The participants in the scientific council noted that long-range weather forecasting includes the most complex and difficult problems of modern science. However, the development of new methods is proceeding very slowly, in part due to the lack of suitable computers and the insufficiency of meteorological information from the entire earth. The scientific council proposed that: 1) a group be formed to prepare a work program on long-range weather forecasting; 2) that there be an increase in the theoretical and practical studies of various forecasting methods; 3) that the effectiveness and quality of these methods be improved. The board of the Hydrometeorological Center recommended that scientists who are working on a single program form a group, that the separate efforts of individual scientists be combined, and that the hydrometeorologists interact with scientists of related fields.

[Translator's Note: This article is a commentary on an article which appeared in GAS Report No 391, 22 February 1977. The article discusses recent work of the USSR Hydrometeorological Center and the unwillingness of its meteorologists to work closely with other specialists.] [5]

Abstracts of Scientific Articles

EFFECTIVENESS OF MODIFICATION OF HAIL PROCESSES IN BULGARIA

Sofia KHIДROLOGIYA I METEOROLOGIYA in Russian No 5, 1976 pp 60-62

[Article by K. Stanchev and P. Simeonov, "Effectiveness of Artificial Modification of Hail Processes in Bulgaria"]

[Abstract] The article discusses the principal weaknesses observed for the routine work in polygons for hail prevention operative in Bulgaria. One of the deficiencies is that radar operating at a wavelength of 3.2 cm cannot indicate all the zones during intensive processes; as a result, there is a screening of hail zones. Many of the polygons have areas greater than the optimum. Measurements of parameters of the first zone sometimes require 10 or more minutes instead of four or less. The radars are not reduced to an identical operating regime and this makes the data for different polygons noncomparable. One of the polygons has length-width dimensions which are completely irrational for protection. Other polygons protect crop areas in which the crop value is quite low. New polygons are being organized rapidly, which does not correspond to the real possibilities of training specialists to work in them. Not all specialists are adhering to the necessary instructions. The paper presents a general analysis of the effectiveness of hail protection in the different polygons. The first polygon was organized in 1969 and since 1975 there have been seven with a total protected area of 1,014,631 hectares. 64% of the total protected area is cultivated.
[363]

CORRELATION BETWEEN CHANGES IN GEOMAGNETIC FIELD, CLIMATE AND CIRCULATION

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 232, No 4, 1977 pp 790-793

[Article by Vatslav Bucha, Geophysical Institute, Czechoslovakian Academy of Sciences, "Correlation Between Changes in the Geomagnetic Field, Climate and Atmospheric Circulation"]

[Abstract] The author discusses the influence of the geomagnetic pole and its position on the earth's surface on atmospheric circulation and weather formation. A study was made of the effect of changes in geomagnetic activity on meteorological parameters, an analysis was made of the levels of atmospheric pressure, and the question of how processes in the polar regions can influence meteorological situations in Europe is discussed. Some of the conclusions are as follows. The correlation between increased geomagnetic activity and a pressure decrease over the geomagnetic pole can be explained as follows. With an intensified influx of electrically charged particles radiation penetrates to the auroral zones, where an electric current with a strength up to 10 A forms along the auroral oval. The magnetic variable fields of this current, in turn, will induce electric eddy currents which can become sources of ohmic heating and cause an expansion of the air masses over the geomagnetic pole and the appearance of low-pressure regions. Geomagnetic activity signals that the corpuscular radiation arriving in the form of the solar wind in the earth's neighborhood and the increase of temperature in the auroral oval cause a decrease in atmospheric pressure over the geomagnetic pole, which is manifested 7 to 15 days later over the territory of central Europe in a decrease in pressure, increased atmospheric circulation, westerly air flow, increased temperature in winter and precipitation. The good correspondence between geomagnetic activity and agricultural production indicates that an increase in corpuscular radiation (of which geomagnetic activity is an indicator) exerts an influence on agricultural production. When there is prolonged geomagnetic activity over the geomagnetic pole there is a decrease in atmospheric pressure. A cyclone gradually develops over the geomagnetic pole; as a result, there is a compression of the Azores anticyclone from north to south. Air movement in the region of the geomagnetic pole around the central cycle occurs counterclockwise, the air enters into the southern part of the Atlantic Ocean and Europe and air movement is established from the eastern shore of North America directly to Europe. This gives rise to temperate winters and increased precipitation, favorable conditions for vegetation.

[287]

RADIOACOUSTIC SOUNDING OF THE ATMOSPHERE

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian
Vol 13, No 3, 1977 pp 245-253

[Article by O. G. Nalbandyan, Institute of Physics of the Atmosphere, "On the Theory of Radioacoustic Sounding of the Atmosphere"]

[Abstract] A study was made of the theoretical and practical possibilities of determining the parameters of the atmosphere by the radioacoustic sounding method. The author gives the principal requirements on the parameters

of systems for the radioacoustic sounding of the atmosphere, allowing for influence of the wind and atmospheric turbulence. On the basis of the determined form of the frequency spectrum of a scattered electromagnetic wave it is shown that there is a possibility for separate determination of temperature and the longitudinal component of wind velocity in the investigated volume.

[37]

REVIEW OF THE PHYSICS OF RECENT CLIMATIC CHANGES

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian
Vol 13, No 3, 1977 pp 227-244

[Article by K. Ya. Kondrat'yev, Leningrad State University, "Some Aspects of the Physics of Recent Climatic Changes"]

[Abstract] This is a review of investigations of the solar constant, optically active small gas and aerosol components of the atmosphere, their optical properties and the influence exerted on radiation transfer from the point of view of the possible effect on climate. Emphasis is on the problem of atmospheric aerosol. There is a brief discussion of the results of work on the numerical modeling of general circulation of the atmosphere and climate, taking into account the influence of small gas and aerosol components. Various ideas are expressed concerning the prospects for further research. Experience with measurements of the solar constant with the "Nimbus-6" satellite revealed the critically great importance of the problem of absolute calibration of radiometers and the timeliness of further investigations for the purpose of establishing an adequate pyrheliometric scale. The unsolved problems of calibration for the time being preclude the possibility of an entirely reliable determination of the value of the solar constant. Further prolonged satellite measurements for detecting possible variations of the solar constant are possible. Observational data indicate a strong spatial-temporal variability of the properties of atmospheric aerosol. This indicates the arbitrariness of any averaged models of aerosol and the need for formulating models taking into account the processes of formation and transformation of global aerosol, taking into account different receipts and losses. The problem of formation of aerosol from the gas phase (this applies especially to a sulfate aerosol) requires particular attention. The complexity of the problem of the gas and aerosol composition of the stratosphere from the point of view of the influence of its variability on climate advances to the forefront the need for further broadening of observations for the purpose of obtaining more reliable data. Different remote-sensing methods must play the primary role. Particularly timely is the formulation of the theory of formation of the gas and aerosol composition of the stratosphere, taking into account photochemistry, dynamics and interaction between the gas and aerosol components. In numerical experiments to determine

the sensitivity of general circulation of the atmosphere and climate to the influence of small components it is necessary to use more realistic models of aerosol and gas composition of the atmosphere. [The paper was presented at the International Radiation Symposium at Garmisch-Partenkirchen, 19-28 August 1976.]

[37]

INTENSITY AND DISTRIBUTION OF SOLAR RADIATION ACCOMPANYING CU CLOUDS

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian
Vol 13, No 3, 1977 pp 264-273

[Article by V. P. Busygin, N. A. Yevstratov and Ye. M. Feygel'son, Institute of Physics of the Atmosphere, "Computation of the Intensity and Distribution of the Fluxes of Direct, Scattered and Total Solar Radiation During Cumulus Clouds"]

[Abstract] Earlier studies contained extensive experimental data on the distribution functions of solar radiation fluxes, making it possible to relate the numerical parameters of the distributions and the tenths of cloud cover. However, until now there has been little study of the influence of the optical-geometrical characteristics of the clouds and the forms of their size distribution on the formation of the fluxes of solar radiation incident on the earth's surface, which is necessary in creating an approximate generalized model of cumulus cloud cover and the radiation heat exchange accompanying it. This paper is devoted to solution of these problems; it is a continuation of an earlier paper by the authors ("Optical Properties of Cumulus Clouds and Radiant Fluxes Accompanying Cumulus Clouds," IZV. AN SSSR, FAO, 9, No 11, 1973), in which they examined the optical properties of individual clouds and computed the solar radiation fluxes under the layer of cumulus clouds. The fluxes of direct, scattered and total radiation and their distributions were computed by the Monte Carlo method and analytically for the stochastic structure of the field of cumulus clouds. The theoretical results agree satisfactorily with experimental data. The authors discuss the influence of solar altitude, dimensions, optical density and quantity of the clouds and other factors.

[37]

III. OCEANOGRAPHY

News

RESEARCH BY "PEGAS" IN WESTERN PACIFIC

Moscow OKEANOLOGIYA in Russian Vol 17, No 1, 1977 pp 171-173

[Article by S. L. Solov'yev and I. K. Tuyezov, "Investigations of the Scientific Research Vessel 'Pegas' in the Western Part of the Pacific Ocean in the Winter of 1975-1976"]

[Abstract] During the period 21 November 1975 through 19 March 1976 specialists aboard the scientific research ship "Pegas" of the Sakhalin Complex Scientific Research Institute carried out a voyage in the western part of the Pacific Ocean (a fold-out map shows the track of the vessel). The purpose of the voyage was a study of the geological structure and geological nature of the Marcus underwater rise. A complex of geophysical and geological methods was used: seismic profiling, gravimetry, magnetometry, depth sounding and dredging. The director of the expedition was I. K. Tuyezov. Depth soundings were made over a distance of 18,588 km, gravimetric measurements -- 17,697 km, magnetometric -- 13,020 km, seismic profiling -- 4,459 km, dredging was carried out in 19 places, six cores were taken, depth soundings were measured over 12 underwater mountains and five earlier unknown mountains with a depth of their peaks less than 1,500 m were discovered. One of the important problems solved by the expedition was the installation of a "Magnavox" MX-702 satellite navigation system aboard the "Pegas"; this makes it possible to tie in geological-geophysical measurement points with an accuracy of about 100 m. During the expedition an EVM M-600 electronic computer was used; in combination with the satellite system this made possible the routine determination of the coordinates of observation points. Two American geophysicists participated in the expedition. Individual parts of this report give the preliminary results obtained by different detachments aboard the ship.

[366]

Abstracts of Scientific Articles

VERTICAL MESOSTRUCTURE OF TEMPERATURE FIELD IN ACTIVE LAYER

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 232, No 3, 1977 pp 552-555

[Article by Yu. M. Kuftarkov and V. K. Kosnyrev, Marine Hydrophysical Institute Ukrainian Academy of Sciences, "Vertical Mesostructure of the Temperature Field in the Active Layer of the Ocean"]

[Abstract] Recent observational data indicate that during periods of frequent change in meteorological conditions in the active layer of the ocean a stepped mesostructure of the temperature field develops whose lifetime is comparable to the mean synoptic scale of nonstationary processes. This structure is a series of quasihomogeneous layers with a thickness up to tens of meters separated by thinner layers with sharp vertical temperature gradients. On the other hand, during periods of winter convection or prolonged storms there is a well-developed two-layer structure of the active layer with a clearly expressed temperature jump, situated directly under the quasi-isothermal layer. The active erosion of the quasi-isothermal layer, occurring during periods of change of meteorological situations, "blurs" the boundary between this layer and the thermocline situated below, so that the temperature profile in the upper layer of the ocean becomes close to continuous. In formulating a model of the continuous evolution of the active layer it is necessary to take into account both the formation of a mesoscale structure in the thermocline and the possibility of transition from a discontinuous to a continuous temperature profile. Such a model is formulated in this paper.

[227]

TURBULENCE OF INTERNAL WAVES IN OCEAN

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian
Vol 13, No 2, 1977, pp 187-193

[Article by Ye. N. Pelinovskiy and M. A. Rayevskiy, Gor'kiy Scientific Research Radiophysical Institute, "Weak Turbulence of Internal Waves in the Ocean"]

[Abstract] The authors examine the kinetic equation for small-scale waves, kinetic equation for large-scale internal waves and the spectra of weak turbulence. On this basis, the author examines the weak turbulence of internal waves in the ocean. It is assumed that oceanic turbulence in a wide range of wave numbers can be regarded as the random field of weakly linear internal waves. The theory of weak turbulence is used for the analysis. The authors find the energy spectra for large- and small-scale internal waves. Also given are evaluations of the applicability of the results under real conditions.

[351]

MODELING OF FLUCTUATIONS OF LIGHT FIELD UNDER WAVES

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian
Vol 13, No 2, 1977, pp 194-200

[Article by V. G. Yakubenko and V. P. Nikolayev, Southern Division Institute of Oceanology, "Numerical Modeling of Fluctuations of the Light Field Under the Wave-Covered Sea Surface"]

[Abstract] A new approach is proposed for the problem of numerical modeling of fluctuations of the underwater light field with allowance for the statistical properties of the wave-covered sea surface. Modeling was carried out using a BESM-4M electronic computer. A study was made of the refraction of parallel light rays on a randomly undulating discontinuity and subsequent propagation of radiation passing through the discontinuity. The statistical properties of the sea surface were stipulated by the spectral energy density of oscillations of the level of the sea surface. The optical properties of the water were stipulated by the indices of scattering and attenuation of directed radiation and also the scattering function. The results of the modeling are compared with the results of field measurements made at different depths. The change in fluctuations of the underwater light field and their spectral energy densities, obtained when using radiation detectors with different angular apertures, is evaluated.

[351]

INTERNAL WAVES AND FINE STRUCTURE OF OCEAN

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 231, No 5, 1976 pp 1080-1083

[Article by V. V. Navrotsky, "Internal Waves and Fine Structure in the Ocean"]

[Abstract] A universal process in stratified flows is internal waves, which are characterized by the presence of many vertical modes. In this article it is shown that this process alone is adequate for the formation of the fine structure. The article examines the peculiarities of internal waves in the presence of maxima in the vertical variation of the Väisälä frequency (which is equivalent to the maxima of the vertical density gradient); then, assuming the density to be dependent only on temperature, a study is made of the interaction of thermal conductivity and internal wave processes. It is shown that the fine structure is manifested as a result of an increase in the transfer coefficients in multimode wave motion, but at the same time becomes the principal factor in maintaining and intensifying the higher modes. Recently many studies suggested allowance for the distorting influence of the fine structure on internal waves. A refinement of this is necessary: in the absence of internal energy sources the fine structure is a part of the field of internal waves in the region of high wave numbers and physically cannot distort it.

[292]

CONTRIBUTION TO STUDY OF OPTICAL RADIATION OF SEA

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY, GEODEZIYA I AEROFOTOS"YEMKA in Russian No 6, 1976 pp 109-114

[Article by V. V. Polovinko, Moscow Institute of Geodetic, Aerial Mapping and Cartographic Engineers, "On the Problem of Investigating Optical Radiation of the Sea"]

[Abstract] The paper cites the results of investigations of the relationships between optical radiation of the sea and waves and contamination of the surface by petroleum. Observations were made in March 1975 in the Caspian Sea. Special apparatus was used consisting of a radiometer with a changeable field, intended for measuring the energy characteristics of optical radiation of the sea in the spectral range $0.4-1.2\mu\text{m}$, $\lambda_{\text{max}} = 0.9\mu\text{m}$; a scanner, a scanning radiometer with circular scanning, operating in the spectral range $0.4-1.8\mu\text{m}$, $\lambda_{\text{max}} = 1.5\mu\text{m}$; an ellipsimeter, designed for measuring the polarization characteristics of optical radiation of the sea, making it possible to register a circular polarization diagram discretely each 22.5° . At the same time, the parameters of sea waves were registered using a GM-61 wave meter. The measurements with the radiometer with a

changeable field made it possible to investigate the change in the temporal spectrum of fluctuations of the intensity of sea radiation. Expressions are derived which make it possible to obtain the characteristics of fluctuations of the intensity of sea radiation on the basis of the geometric characteristics of the surface and to obtain the geometrical characteristics of the wave-covered surface by using measurements of the intensity of sea radiation. Active and passive methods for investigating sea regions contaminated by petroleum and petroleum products are discussed, followed by polarization methods which can be employed for this same purpose.

[41]

FINE STRUCTURE OF THERMODYNAMIC FIELDS IN OCEAN

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERI I OKEANA in Russian
Vol 13, No 2, 1977 pp 207-209

[Article by A. G. Volochkov and N. N. Korshachkin, Institute of Oceanology, "Some Results of Statistical Analysis of the Fine Structure of Thermodynamic Fields in the Ocean"]

[Abstract] The statistical approach to an analysis of the fine structure of thermodynamic fields in the ocean is based on the discrimination in the vertical profiles of hydrophysical fields of individual layers of different thickness with constant (within the layer) vertical gradients of the investigated characteristics. The algorithm for this procedure was published earlier. It was used for processing vertical profiles of temperature, salinity and the horizontal components of current velocity obtained using low-inertia sounding instruments on the 11th voyage of the research vessel "Dmitriy Mendeleev." As a result, for each profile it was possible to obtain series of values of the thicknesses of the layers and the corresponding vertical gradients and these were used in computing the empirical probability densities $P(L)$ and $P(A)$. It was found that the $P(L)$ histograms have universality and the L value with sufficient reliability is described by a log-normal distribution law. The histograms $P(A)$ are characterized by diversity. Their form is dependent on the large-scale peculiarities of the investigated fields. A figure shows examples of the empirical joint probability densities of thicknesses of layers and the vertical gradients $P(L, A)$, computed on the basis of measurements of thermodynamic fields in the Pacific Ocean in an equatorial polygon. It was found that the mean values of the vertical gradients of elements of the fine structure of thermohaline fields, computed using L_j and A_j series, coincided with the vertical temperature and salinity gradients obtained using standard hydrological observations. These results give basis for assuming the presence of stable correlations between the statistical characteristics of the fine structure and the mean values of the parameters of large-scale temperature and salinity fields in the investigated region of the ocean.

[351]

VERTICAL STRUCTURE OF CURRENTS IN OCEAN

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian
Vol 13, No 3, 1977 pp 328-331

[Article by V. M. Vasilenko and A. P. Mirabel', Institute of Oceanology,
"Vertical Structure of Currents in the Ocean in Different Frequency Ranges"]

[Abstract] In the investigation of the vertical structure of ocean currents extensive use is made of the method of empirical orthogonal functions (EOF). It was found that for a sufficiently reliable description of the vertical structure of hydrophysical fields in the ocean in optimum expansions it is necessary to take a greater number of terms than for the atmosphere. The nature of the multimodality of optimum expansions can be ascertained by investigating the statistical properties of time series of currents subject to filtering, that is, by examining separately the large-scale movements, inertial oscillations, etc., and evaluating the necessary number of modes for each individual process. The paper gives the results of such an investigation using data for the Atlantic Ocean polygon. The data employed were for a buoy station situated at a point with the coordinates $16^{\circ}30'N$ and $33^{\circ}30'W$ for the period from 12 July to 13 September 1970 at the levels 25, 50, 100, 200, 300, 400, 500, 600, 1,000 and 1,500 m. There was found to be three intervals of periods corresponding to synoptic variability: periods of variations from the center of the synoptic minimum with $T \approx 4$ days in the direction of the low frequencies, inertial movements with a period of about 42 hours, and a high-frequency spectral region including with tidal variations with a semidiurnal period and internal waves. It is shown that the expansion of the field of currents in EOF is most effective in describing the vertical structure of synoptic processes and in its parameterization in mathematical models of large-scale currents in the Tropical Atlantic one can limit the analysis to the first two modes.
[37]

OPTICAL CLASSIFICATION OF OCEAN WATERS

Moscow OKEANOLOGIYA in Russian Vol 17, No 1, 1977 pp 50-54

[Article by V. N. Pelevin and V. A. Rutkovskaya, Institute of Oceanology,
"On the Optical Classification of Ocean Waters Using the Spectral Attenuation of Solar Radiation"]

[Abstract] One of the principal problems in marine optics is the study of the selective attenuation by water of the sunlight incident on the sea surface. Data of this type are necessary for evaluating the conditions for existence of a marine biocoenosis at different depths. The closeness of the index of vertical attenuation of light α_{λ} to the value of the absorption index makes it possible to estimate the degree of contamination of water by different impurities absorbing light. In this paper the results

of the changes measured with underwater monochromators are compared with the Yerlov classification. It is shown that there is a substantial difference between measurement data and the Yerlov classification (OPTICHESKAYA OKEANOLOGRAFIYA, "Mir," Moscow, 1970). Accordingly, for the optical classification of waters the authors propose use of the index of vertical attenuation at $\lambda = 500$ nm. A nomogram is presented for this purpose.
[366]

CONTACTLESS TRANSMISSION OF DIGITAL DATA

Moscow OKEANOLOGIYA in Russian Vol 17, No 1, 1977 pp 164-167

[Article by G. S. Belogradov and L. S. Sitnikov, Institute of Oceanology, "Communication System with Contactless Transmission of Digital Data Through an Electric and Supporting Cable"]

[Abstract] Specialists in the Computer Laboratory at the Institute of Oceanology have developed an original method for the contactless transmission of signals using a slide which slides along an electric and support cable in sea water. The output signal of such a communication line is the difference in voltages induced in the coaxial pair of cables. This difference is manifested as a result of shunting of the cable braiding by sea water. The KOBDFM-2 cable was tested at sea on the 20th voyage of the "Akademik Kurchatov." Specialists experimentally registered the stable reception of data from a freely falling hydrophysical probe descending to a depth of 1,200 m, at a carrier frequency of 270 KHz. Positive results were also obtained with the transmission of signals from these same depths at carrier frequencies of 0.5 and 1.0 MHz. In both cases the power consumed by the transmitting unit of the submersible instrument did not exceed 150-200 mW. The absence of a mechanical coupling of the probe with the line, making it possible to exclude the influence of rolling of the vessel on the measurement data and the high electric characteristics of the channel indicate the great promise of the proposed transmission method and the desirability of developing corresponding supplementary apparatus. A block diagram of the transmitting unit accompanies the text and serves as a basis for a discussion of functioning of the system. This is followed by a block diagram of the receiving unit and a corresponding description. Use of frequency manipulation of a two-position code is explained.
[366]

STATISTICAL ANALYSIS OF INTERMITTENT OCEAN TURBULENCE

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian
Vol 13, No 1, 1977 pp 105-108

[Article by G. I. Bodyakov, V. A. German and R. V. Ozmidov, Institute of Oceanology, "Statistical Analysis of Intermittent Turbulence in Ocean"]

[Abstract] In this analysis of intermittent turbulence in the ocean it is postulated that in general for a sufficient volume of the ocean the process is stationary. In this case the characteristics of intermittent turbulence in the ocean can be the volume in which there is a fixed number of turbulent spots (or the number of spots in a fixed volume of the ocean) and the geometrical dimensions of the spots themselves, as well as the interrelationships of the formations. Another important characteristic of the intermittence will be the ratio of the volume occupied by the turbulent spots to the entire considered volume of fluid. Also important is the energy characteristics of the turbulent spots, such as the energy of the fluctuations of the investigated hydrophysical field, averaged for the volume of the spot. A more complex characteristic of intermittence is the statistical correlations of the spatial and energy characteristics of spots spaced in space and time. The authors have used these characteristics in their study. It is shown that the records obtained in each experiment can be considered records with the following properties: records of the process constitute a sequence of alternating segments of noise and segments of signals characterizing the turbulence spots: the lengths of the segments of noise and segments of signals are random values whose stochastic properties are described by some distribution functions; the stochastic properties of the noise are described by the same distribution function for all noise segments of the record; the stochastic properties of the signals are described by distribution functions whose parameters vary with transition from one segment of the signal (turbulence spot) to another and represent random values with some distribution functions. The results of application of these concepts and findings to measurements of conductivity fluctuations in the Barents Sea at depths of 100-125 m are given.

[228]

ACOUSTIC METHOD FOR DETERMINING SHIP'S SPEED

Moscow OKEANOLOGIYA in Russian Vol 17, No 1, 1977 pp 158-163

[Article by V. I. Volovov, V. V. Krasnoborod'ko, Yu. P. Lysanov and V. A. Sechkin, Acoustics Institute, "New Acoustic Method for Determining a Ship's Speed"]

[Abstract] The results of theoretical and experimental investigations of spatial and temporal correlation of fluctuations of the envelopes of acoustic signals reflected by the the ocean floor with the normal incidence of

sound make it possible to solve the problem of determining the speed of a ship relative to the bottom by relatively simple means. The idea of the method is based on the simultaneous measurement of the coefficients of auto- and cross-correlation of fluctuations of the envelopes of acoustic signals reflected from the ocean floor. The theoretical basis and the practical implementation of the method are discussed. Experiments for evaluating a ship's speed by the proposed method were carried out in 1973-1975 aboard the "Petr Lebedev" both at drift and at different speeds. Since the proposed method makes it possible to measure small rates of movement, it can be used not only on ships, but also on submarines and on drifting ice.

[366]

COMPENSATION OF CROSS COUPLING EFFECT IN MARINE GRAVIMETRY

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ZEMLI in Russian No 2, 1977
pp 87-90

[Article by Ye. A. Vorontsova, B. G. Zelenskiy, V. A. Kuzivanov, S. V. Kuzivanov, L. D. Nemtsov, S. P. Fomin and A. V. Chernyshov, Institute of Physics of the Earth, "On the Problem of Compensating the Cross Coupling Effect in Marine Gravimetric Measurements by the 'Points of Intersection' Method"]

[Abstract] In an earlier study (V. A. Kuzivanov, et al., MORSKIYE GRAVIMETRICHESKIYE ISSLEDOVANIYA, Izd-vo MGU, No 8, 1975), in the example of harmonic horizontal and vertical accelerations, it was demonstrated that at points of "intersection" there is a compensation of the constant (systematic) part of the cross coupling effect by vertical accelerations, and the regular part of the CC effect is inversely proportional to the time constants of the sensing systems of the gravimeters and is two orders of magnitude less than the total influence of the CC effect in the readings of an individual pendulum. In the earlier study the authors raised the question as to whether there is compensation of vertical acceleration and the cross coupling effect in a real nonharmonic variant. This paper is devoted to solution of this problem. The data presented show that at the points of "intersection" there is a compensation of the influences of the vertical accelerations and the cross coupling effect. If for an individual pendulum the influence of the vertical accelerations is 1000 mgal, the residual influence at the points of "intersection" is only 20 mgal, that is, 50 times less. With respect to the cross coupling effect, it was found that the constant part of the CC effect for a single pendulum attains 500 mgal, but at points of "intersection" is 10 mgal, that is, also 50 times less. The regular part of the CC effect for an individual pendulum is 250 mgal, and at points of "intersection" -- 5 mgal, that is, again 50 times less. It can therefore be said that at points of "intersection" the gravimeter readings are virtually free of the influence of the cross-coupling effect.

[352]

KORTEWEG-DE VRIES EQUATION FOR INTERNAL WAVES IN INHOMOGENEOUS OCEAN

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian
Vol 13, No 3, 1977 pp 325-328

[Article by Ye. N. Pelinovskiy, M. A. Rayevskiy and S. Kh. Shavratskiy, Gor'kiy Radiophysics Scientific Research Institute, "Korteweg-De Vries Equation for Nonstationary Waves in Inhomogeneous Ocean"]

[Abstract] A study was made of the propagation of nonstationary internal waves of finite amplitude in an ocean whose stratification changes smoothly horizontally. On the basis of an approximate separation of variables for internal waves it was possible to derive a generalized Korteweg-De Vries equation with variable coefficients determined by solution of the corresponding boundary-value problem. There is a discussion of the role of different factors ensuring horizontal inhomogeneity and the possibility of conservation of the energy flux of a nonlinear wave. Using the conservation law, it is possible to describe the change in the characteristics of a nonlinear internal wave. It is shown that during propagation of an internal wave of finite amplitude, due to horizontal inhomogeneities there can be a substantial change in the form of the wave (from sinusoidal to a series of solitons) and a considerable increase in its amplitude. A single wave in this case can be destroyed, despite the smoothness of the change in stratification.

[37]

THEORY OF EQUATORIAL COUNTERCURRENT IN BAROCLINIC OCEAN

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian
Vol 13, No 3, 1977 pp 298-308

[Article by G. K. Korotayev, E. N. Mikhaylova and N. B. Shapiro, Marine Hydrophysical Institute Ukrainian Academy of Sciences, "On the Theory of an Equatorial Countercurrent in a Baroclinic Ocean"]

[Abstract] The article is devoted to the formulation of a nonlinear, nonstationary model of a countercurrent in a continuously stratified ocean. For this purpose the concept of a baroclinic layer proposed for an internal region of the ocean (L. N. Gutman, IZV. AN SSSR, FAO, 5, No 9, 1970 and P. S. Lineykin, METEOROLOGIYA I GIDROLOGIYA, No 12, 1970) is generalized for an investigation of the boundary layers. The authors clarify the process of formation of the subsurface countercurrent at the equator and the observed characteristics of the temperature field (rising of the isotherms toward the east, spreading of the thermocline at the equator) in the equatorial baroclinic layer.

[37]

IV. TERRESTRIAL GEOPHYSICS

News

PAPERS ON SEISMIC WAVES FROM EARTHQUAKES AND EXPLOSIONS

Moscow REFERATIVNYY ZHURNAL, GEOLOGIYA, SVODNYY TOM in Russian No 12, 1976
12D132K

[Abstract of collection of papers; Moscow, SOSTOYANIYE I PERSPEKTIVY RAZVITIYA METODOV POPERECHNYKH I OBMENNYKH VOLN V SEYSMORAZVEDKE. MATERIALY SEMINARA PO RAZDELU: "PROKHODYASHCHIYE OBMENNYE VOLNY OT ZEMLETRYASENIY I VZRYVOV," SARATOV, 1974 (Status and Prospects for the Development of Methods Using Transverse and Exchange Waves in Seismic Prospecting. Materials of the Seminar on the Subject: "Transmitted Exchange Waves from Earthquakes and Shots," Saratov, 1974), Ministry of Geology USSR, All-Union Scientific Research Institute of Geophysical Prospecting Methods, 1976, 142 pages]

[Text] Materials from the seminar on methods of seismic prospecting based on the use of exchange and transverse waves (Saratov, April, 1974), devoted to different aspects of methods for the observation and interpretation of exchange waves registered by "Zemlya" stations, are presented. The articles examine the general status of work methods and the results of investigations with "Zemlya" stations in different geotectonic provinces. Much attention is devoted to the problems involved in the interpretation of materials obtained in complexly structured regions with slant discontinuities and also the problem of determining the nature of discontinuities in the earth's crust. Included is a method for determining the velocities of longitudinal and transverse waves directly under the observation point by means of use of kinematic and dynamic characteristics of waves from shots. Also given is a brief description of the new "Zemlya-73" instrument complex. The directions for further improvement of seismic work with the use of the "Zemlya" apparatus are defined.

[42]

Abstracts of Scientific Articles

STRESSED STATE OF EARTH'S CRUST IN ARMENIA

Moscow GEOTEKTONIKA in Russian No 2, 1977 pp 75-84

[Article by G. V. Yegorkina, V. A. Rakitov, I. V. Garetovskaya and L. M. Yegorova, All-Union Scientific Research Institute of Geophysics, "Stressed State of the Earth's Crust in the Territory of Armenia According to Seismic Data"]

[Abstract] The authors discuss the problem of the relationship between the anisotropy of velocities of seismic waves and the stressed state of the earth's crust in the territory of Armenia. The article gives the results of study of anisotropy using the records of transverse waves registered at a distance from 5 to 450 km from the epicenter and exchange waves of the type of PS waves forming at the basement surface. Also considered is the relationship between the nature of the anisotropy of velocities and the direction of the main axes of stresses in the focal zones. The authors analyze the dependence of the spatial distribution of zones of increased anisotropy of velocities on the geological structure of the region. On the basis of the results presented here the conclusion is drawn that the principal reason for the anisotropy of velocities in the territory of Armenia is the stressed state of the earth's crust. Clarification of the location of regions of increased anisotropy of the velocities of S-waves makes it possible to discover zones of possible foci of future earthquakes.

[38]

COMPUTING LENGTHS AND AZIMUTHS OF CLOSING LINES ON SPHEROID

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY, GEODEZIYA I AEROFOTOS"YEMKA in Russian No 6, 1976 pp 37-47

[Article by A. A. Kolosov, Kuzbass Polytechnic Institute, "Computation of the Lengths and Azimuths of Chords of Closing Lines on a Spheroid on the Basis of the Delambre Theorem"]

[Abstract] A method is proposed for computing the lengths and azimuths of closing chords in the links of first-order geodetic networks. The method is based on the projection of polar triangles of the link onto "modified" Delambre planes. It is noted that it is possible to use the method in the scaling of satellite geodetic networks and in the processing of spatial triangulation networks. An example of processing a first-order link is given. The method is similar to the little-known Professor V. V. Popov method for computing the lengths and azimuths of closing lines in the links of first-order triangulation.

[41]

REGULARIZED SOLUTION OF THE MOLODENSKIY PROBLEM

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY, GEODEZIYA I AEROFOTOS"YEMKA in Russian No 6, 1976, pp 23-26

[Article by Yu. M. Neyman and L. A. Timofeyeva, Moscow Institute of Geodetic, Aerial Mapping and Cartographic Engineers, "Expansion of the Regularized Solution of the Molodenskiy Problem into a Series"]

[Abstract] The Molodenskiy boundary-value problem for determining the disturbing potential T of the earth's gravity field is considered. A solution of the problem is sought among a set of functions, harmonic in external space relative to the medium, situated completely within the earth's body. Such an approach to a solution follows directly from the Tikhonov general regularization theory, in accordance with which the problem is reduced to minimizing the smoothing functional by means of series in spherical functions under the condition that the square of the norm at the surface of the selected sphere is a stabilizer of the problem. As a result, the authors have obtained a system of linear algebraic equations for the coefficients of expansion of the sought-for functional potential T into a series in spherical functions.

[41]

APPARATUS FOR GRAVIMETRIC MEASUREMENTS AT SEA

Moscow REFERATIVNYY ZHURNAL 52. GEODEZIYA I AEROS"YEMKA, OTDEL'NYY VYPUSK in Russian No 11, 1976 11.52.111

[Abstract of article by V. O. Bagramyants, V. G. Budanov, K. N. Kozhanov and I. V. Kozhuk; Sevastopol', KOMPLEKS. GEOFIZ. ISSLED. SREDINNO-ATLANTICH. KHREBTA, 1975, pp 151-159, "Apparatus for Gravimetric Measurements at Sea"]

[Text] The article describes the GMKP (gravimetr morskoy kvartsevyy pruzhinnyy -- sea quartz spring gravimeter), developed at the All-Union Scientific Research Institute of Geophysics by late 1966 and tested at sea for the first time in 1967. Its principal specifications are given. Also given are the peculiarities of design and construction and some advantages in comparison with other Soviet-produced (SZ, GAL) and foreign (LCR, GSS) sea gravimeters. The authors examine the matters of calibration, determination of null-point drift and evaluation of the accuracy of the results of measurements with the GMKP instruments Nos 3 and 4 on the seventh and eighth voyages of the scientific research vessel "Akademik Vernadskiy" in the Atlantic Ocean. On the basis of a comparison of the measured g values at 24 points of intersection of runs, the accuracy of the survey in an ocean polygon is characterized by an error ± 5.5 mgal (with an internal agreement for the gravimeters of 1-2 mgal and an error in the matching of observations of about ± 1 mile). A gravimetric map with isoanomalic lines drawn each 15 mgal was compiled. There is stability and an insignificant null-point shift on the runs (about 0.2-0.3 mgal/day). The seventh run lasted 119 days and the eighth -- 130 days. The initial station was Sevastopol'. The control points were Las Palmas (Canary Islands), La Guaira (Venezuela), Wilhelmstad (Curacao), Barcelona, Dakar (Senegal), Santa Cruz (Canary Islands), Naples. The intervals between observations at the control points attained 25-30 days, sometimes 40-60 days.

[331]

MATHEMATICAL MODEL OF ELECTRONIC DISTANCE MEASUREMENT

Moscow REFERATIVNYY ZHURNAL 52. GEODEZIYA I AEROS"YEMKA, OTDEL'NYY VYPUSK in Russian No 11, 1976 11.52.76K

[Abstract of article by M. Schadlich; East Berlin, ARB. VERMESS. UND KARTENW. DDR, 36, 1976, 85 pages, "Mathematical Model of an Electronic Method for Distance Measurement"]

[Text] The author sets forth the theoretical principles of modeling and optimization of geodetic measurements by means of Gaussian random processes. In particular, it was found that a mathematical model of direct and indirect measurements of distances for one- and multiwave methods could be formulated. Also considered is the influence of the atmosphere and relief on the integral refractive index for light and radio waves. It was possible to establish the values of the systematic errors caused by the inequality of the heights of the trajectory of electromagnetic oscillations above the earth's surface and the height of determination of the meteorological parameters. The magnitude of these errors for light and radio waves are equal to $3 \cdot 10^{-6}$ and $15 \cdot 10^{-6}$ respectively. A formula is derived for the additional reduction term ΔN , resting on a physical-statistical basis. On the basis of corresponding experimental measurements carried out in standard networks in Austria, West Germany, Switzerland, the USSR and other countries

it was established that the most favorable periods for the measurement of distances by the electronic methods are periods of isothermy, whereas for radio rangefinder measurements it is periods when the air temperature is close to zero $t > 0^\circ$. One should not project the trajectories of measurements over water surfaces or work under conditions of considerable inversion of atmospheric layers. Bibliography of 70 items.
[31]

COMPUTATION OF GRAVITATIONAL ANOMALIES

Moscow REFERATIVNYY ZHURNAL, GEOLOGIYA, SVODNYY TOM in Russian No 12, 1976
12D152

[Text] The article gives an algorithm for obtaining the output signal of a system proportional to the gravitational anomaly. The minimum necessary number of components of the system and their functions are determined.
[42]

PROGRAMMED VOLUME CONTROL SYSTEM FOR SEISMOACOUSTIC STATIONS

Moscow REFERATIVNYY ZHURNAL, GEOLOGIYA, SVODNYY TOM in Russian No 12, 1976
12D112

[Abstract of article by V. G. Shevchenko; --, TRUDY GOS. PROYEKT.-IZYSKAT. I NII MOR. TRANSP., No 40(46), 1976, pp 133-135, "Device for Programmed Volume Control for Seismoacoustic Stations"]

[Text] The author examines the conditions for the propagation (in water and in the bottom) of signals from an electrospark source of elastic oscillations and the noise signals accompanying them. The article describes the unit for programmed volume control for useful signals in conformity to a linear law for stipulated time and dynamic ranges. The computed and experimentally determined characteristics of an adjustable element with field triodes are given.
[42]

CORRELATOR OF SEISMOACOUSTIC PROFILING SIGNALS

Moscow REFERATIVNYY ZHURNAL, GEOLOGIYA, SVODNYY TOM in Russian No 12, 1976
12D113

[Abstract of article by V. G. Shevchenko; --, TRUDY GOS. PROYEKT.-IZYSKAT. I NII MOR. TRANSP., No 40(46), 1976, pp 136-138, "Amplitude-Time Correlator of Seismoacoustic Profiling Signals"]

[Text] The criteria for differentiating a useful signal from an interference signal in seismoacoustic profiling are considered. The article describes an original device for the multichannel automatic processing of signals on seismoacoustic trajectories. Dynamic, kinematic and static criteria are used for the discrimination of useful signals.

[42]

REGIONAL MAGNETIC ANOMALIES IN THE OCEANS

Moscow REFERATIVNYY ZHURNAL, GEOLOGIYA, SVODNYY TOM in Russian No 12, 1976
12A437

[Abstract of article by A. M. Karasik; Kiev, MAGNIT. ANOMALII ZEMN. GLUBIN., "Nauk. Dumka," 1976, pp 170-185, "Problems in Regional Magnetic Anomalies in the Oceans"]

[Text] Taking into account the initial position that an anomalous magnetic field of the oceanic type has an essentially inversionally spreading nature, it is proposed that all anomalies of an inversion nature be assigned to the "local" class, regardless of their extent along the strike or across it. It is proposed that all noninversion anomalies whose minimum dimension at sea level exceeds several tens of kilometers (such as 30-50) be considered regional anomalies. The author expresses some ideas concerning the nature of regional anomalies. However, due to the absence of reliable data they are extremely controversial.

[42]

EARTHQUAKE PREDICTION IN THE BAYKAL RIFT ZONE

Moscow REFERATIVNYY ZHURNAL, GEOLOGIYA, SVODNYY TOM in Russian No 12, 1976
12A411

[Abstract of article by V. P. Solonenko; Tashkent, POISKI PREDVESTNIKOV ZEMLETRYASENIY, "Fan," 1976, pp 172-179, "Prediction of Earthquakes in the Baykal Rift Zone on the Basis of Geological-Geophysical Data"]

[Text] It is demonstrated that it is impossible to predict the time of occurrence of an earthquake. For practical purposes it is most important to determine the place, intensity and possible frequency of recurrence of destructive earthquakes. The proposed paleoseismic method makes it possible to clarify the relationship between earthquakes and specific structures and compile maps of the level of potential seismicity of focal zones and seismic regionalization of the Baykal rift zone. The necessity for a seismoen-gineering forecast is mentioned. Bibliography of 26 items.

[42]

EARTHQUAKE PRECURSORS IN THE SAKHALIN-KURILE REGION

Moscow REFERATIVNYY ZHURNAL, GEOLOGIYA, SVODNYY TOM in Russian No 12, 1976
12A413

[Abstract of article by Ye. K. Markhinin, F. I. Monakhov, L. S. Oskorbin, G. L. Chervyakova and G. G. Yakushko; Tashkent, POISKI PREDVESTNIKOV ZEMLETRYASENIY, "Fan," 1976, pp 219-220, "Effects Warning of Strong Earthquakes in the Neighborhood of Sakhalin and the Kurile Islands"]

[Text] Prior to the Moneronskoye earthquake of 5 September 1971 ($M = 7.2$, $h = 1.5$ km) instruments registered an anomalous variation of the registered differences in sea level. The changes in seismic parameters incompletely corresponded to the requirements of the theory of dilatation. In the Kurile Islands there was a decrease in the coefficient of aftershocks prior to the Shikotanskoye earthquake of 11 August 1969 ($M = 8.2$). On Kunashir Island there was an increase in the chlorine content by 10% and of carbon dioxide by 3% in 1966 in comparison with 1965. There was a corresponding increase in the number of tremors registering 4-5 seismic scale units -- from 3 to 12.

[42]

DEFINITION OF SEISMICALLY DANGEROUS ZONES FROM GEOLOGICAL DATA

Moscow REFERATIVNYY ZHURNAL, GEOLOGIYA, SVODNYY TOM in Russian No 12, 1976
12A407

[Abstract of article by B. A. Borisov, G. I. Reysner and V. N. Sholpo; Tashkent, POISKI PREDVESTNIKOV ZEMLETRYASENIY, "Fan," 1976, pp 88-92, "Definition of Seismically Dangerous Zones on the Basis of Geological Data for the Territory of Czechoslovakia, Hungary and Rumania"]

[Text] A study was made of the application of the method for evaluating seismic danger on the basis of a complex of geological data for Czechoslovakia, Hungary and Rumania. The method involves the compilation of a series of maps: historical-structural, most recent tectonic movements, recent movements, geological criteria of seismicity, and zones of relative seismic danger on the basis of geological data. A joint analysis of the last map with seismic data makes it possible to construct a map of zones of occurrence of the foci of strong earthquakes, assigning them a magnitude evaluation. Bibliography of 13 items.

[42]

INVERSE KINEMATIC PROBLEMS OF SEISMICS OF REFLECTED WAVES

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 233, No 1, 1977 pp 64-67

[Article by S. V. Gol'din, Siberian Division, Institute of Geology and Geophysics, "One Inverse Kinematic Problem in the Seismics of Reflected Waves"]

[Abstract] The inverse kinematic problem of the seismics of reflected waves involves a reconstruction of the depth and form of the reflecting boundary $z = h(x)$, and also the distribution of propagation velocity v in the covering medium from the travel times t of the reflected wave, obtained for different positions of the source x_1 and the receiver x_2 . In this communication the author examines the inverse problem for the medium $v = v(z)$, $0 \leq z \leq h(x)$. The function $v(z)$ is assumed to be piecewise-smooth and $h(x)$ is considered continuous together with the first derivative, and in this formulation the inverse problem is solved.

[353]

AUTOMATION OF GEOPHYSICAL RESEARCH

Moscow REFERATIVNYY ZHURNAL, GEOLOGIYA, SVODNYY TOM in Russian No 12, 1976 12D64

[Abstract of article by A. P. Yemel'yanov; Minsk, VOPR. GEOL. BELORUSSII, "Nauka i Tekhn.," 1976, pp 144-148, "Problems in the Automation of Geophysical Research"]

[Text] At the present time the structure of systems for the processing of geophysical information is in the stage of development and introduction. It is pointed out that the most effective operating regime for a system for the remote processing of geophysical information is an autonomous regime (the data are first registered on information carriers). The author gives estimates of the indices of effectiveness of a data transmission system, such as the time required for data transmission, handling capacity, probability of transmission of errors and reliability. The main task in the automation field, requiring solution in the near future, is the further development of a closed system for the collection and processing of geophysical information.

[42]

DEVELOPMENT OF GEOPHYSICAL INFORMATION SYSTEM

Moscow REFERATIVNYY ZHURNAL, GEOLOGIYA, SVODNYY TOM in Russian No 12, 1976 12D65

[Abstract of article by T. Bugno, B. Cianciara, H. Marcak and R. Slusarczyk, Warsaw, PRZ. GEOL., 24, No 5, 1976, pp 286-287, "Development of Geophysical Data System"]

[Text] The authors examine the principal directions in the work of the Information Division of the Interdepartmental Institute of Applied Geophysics and Petroleum Geology at the Mining-Metallurgical Academy at Cracow. The modern interpretation of geophysical data requires the broad use of electronic computers. Emphasis has been on the development of algorithms and computer programs for the mass processing of geophysical data. In particular, the algorithms and programs apply to the statistical processing of geophysical data: filtering methods in the interpretation of potential fields; multichannel, optimum filtering in seismics; prediction of cave-ins in mine workings on the basis of data from seismic and acoustic measurements. The article also cites theoretical investigations in the field of dispersion of channel waves. Bibliography of eight items.

[42]

DEEP STRUCTURE OF EARTH'S CRUST IN PACIFIC OCEAN

Moscow REFERATIVNYY ZHURNAL, GEOLOGIYA, SVODNYY TOM in Russian No 12, 1976
12A445

[Abstract of article by A. G. Gaynanov, A. M. Gorodnitskiy, L. I. Krasnyy, Yu. A. Pavlov, O. G. Sorokhtin, S. A. Ushakov and V. V. Fedynskiy; Moscow, MEZHDUNAR. GEOL. KONGR. XXV SESSIYA. DOKL. SOV. GEOLOGOV. GEOFIZ. ISSLED. ZEMN. KORY, "Nedra," 1976, pp 9-18, "Geophysical Fields and Deep Structure of the Earth's Crust in the Pacific Ocean"]

[Text] This is a generalization of geophysical data for the entire area of the Pacific Ocean and its margins. Maps at a scale of 1:10,000,000 were compiled for gravitational anomalies in different reductions, seismicity, magnetic anomalies, heat flow and thickness of the earth's crust. The analysis of data was made from the point of view of the tectonics of lithospheric plates. The article describes a model of formation of the oceanic lithosphere due to the crystallization of the basaltic component in asthenospheric matter. The thickness of the oceanic lithosphere increases proportionally to the square root of its age. It is noted that the greater part of the heat within the limits of the East Pacific Ocean Rise is transported by the ocean water circulating in a system of fractures and therefore the earth's total heat losses must be considered greater than those usually adopted by 30-40%. In regions of plunging of lithospheric plates in the frontal part of an overthrust plate a wedgelike projection with a length up to 100-150 km and a thickness at the base up to 20-25 km is formed. The dynamic effect of an underthrust leads to impairments in isostasy and the characteristic relief of island arcs. A regionalization of the lithosphere in the Pacific Ocean and its margins is given. Bibliography of 11 items.

[42]

HORIZONTAL PROPAGATION OF GEOMAGNETIC PULSATIONS

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ZEMLI in Russian No 1, 1977
pp 73-76

[Article by D. N. Chetayev, V. A. Morgunov, S. V. Shamanin, B. M. Alekseyev, L. B. Papushina and Ye. N. Fedorov, Institute of Physics of the Earth, "Horizontal Propagation of Geomagnetic Pulsations"]

[Abstract] The article presents the results of determination of the characteristics of horizontal propagation of geomagnetic pulsations with respect to the amplitude-phase relationships of field components. The data analyzed were from synchronous observations of all six components of geomagnetic pulsations obtained on an expedition of the Institute of Physics of the Earth on the Ukrainian crystalline shield. The presented data show a satisfactory agreement of data from two spaced stations. There is a dependence of the velocities of spatial attenuation on the level of geomagnetic activity.

[252]

ANALYSIS OF SOIL MOTION FROM EARTHQUAKE RECORD

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ZEMLI in Russian No 1, 1977
pp 77-83

[Article by Ye. F. Savarenskiy, G. L. Kosarev and F. S. Sadikov, Institute of Physics of the Earth, "Reconstructing the True Motion of the Soil from an Earthquake Record"]

[Abstract] In this study an attempt is made to improve the spectral method for reconstructing the true motion of the soil from an earthquake record. The scheme for computing the true motion of the soil described here was programmed in ALGOL-60 language and computations were made using a BESM-6 computer. The proposed method is based on the Fourier transform. The algorithm proposed here provides for the selection of the optimum limits of frequency integration and the optimum form of the low-frequency part of the spectrum of true motion of the soil. Examples of specific computations are given.

[252]

CRUSTAL STRUCTURE IN PACIFIC OCEAN

Moscow SOVETSKAYA GEOLOGIYA in Russian No 1, 1977 pp 148-151

[Article by A. P. Milashin, Gelendzhik Division Scientific Research Institute of Marine Geophysics, "New Data on Crustal Structure of Pacific Ocean"]

[Abstract] The strike of isopachous lines of the earth's crust in the oceans most frequently agrees with the outline of major tectonic and geomorphological zones -- continents, ocean basins and mid-oceanic ridges. In the Pacific Ocean this pattern is not observed everywhere, evidently attributable to the non-midoceanic position of the East Pacific Ocean Rise. There are two regions for which the strike of the crustal isopachous lines is different. In the western part of the ocean it is submeridional, and in the northeastern part -- sublatitudinal. The change in strikes occurs in the neighborhood of the Hawaiian Islands. The article is accompanied by a two-page map showing a comparison of the results of drilling with data from geophysical investigations showing the axes of magnetic anomalies, isothicknesses of the earth's crust, isochronous lines of geological boundaries, fault zones and the East Pacific Ocean Rise. Emphasis is on the presence of sublatitudinal blocks of the earth's crust separated by the Mendocino fault zones. These blocks are bounded on the west by a stable platform over the area of which Cenozoic magmatism had a limited occurrence.

[268]

MECHANISM FOR EXTRUSION OF HYPOMAGMATIC MELTS

Yerevan IZVESTIYA AKADEMII NAUK ARMYANSKOY SSR, NAUKI O ZEMLE in Russian
Vol 29, No 6, 1976 pp 8-14

[Article by A. T. Aslanyan, Institute of Geological Sciences Armenian Academy of Sciences, "A Compressing Earth as the Filter-Pressing Mechanism for the Extrusion of Hypomagmatic Melts"]

[Abstract] There has been no adequate quantitative evaluation of the energetic possibilities of the principal processes which are responsible for the rising of magma from the mantle to the surface. In this paper the rising of magma melts and virtually incompressible flowing hypomagmatic masses in general is considered for the most part to be the result of the earth's general gravitational compression causing their squeezing out in the filter-pressing mechanism (in both lateral and radial directions) and movement into zones of dislocations. Other mechanisms of the rising of magma are regarded as being superposed on the basic process of gravitational filter-pressing. The formulation of the problem in the sense of functioning of the filter-pressing mechanism requires the earth's compression, rupturing of the lithosphere and the presence of a sufficient quantity of energy ensuring the rising of magma melts. These three aspects of the problem are considered in detail. It is shown that the heat flow from the earth and the filter-pressing mechanism of extrusion of relatively fluid fractions of deep matter with a low viscosity and the degassing of this matter together constitute phenomena minimizing the free energy and entropy of the earth and preventing its deviations from a state of stable equilibrium.

[371]

REFINED APPROACH IN QUANTITATIVE INTERPRETATION OF GRAVITY ANOMALIES

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 232, No 3, 1977 pp 548-551

[Article by P. I. Balk, Geochemistry Institute, Siberian Department USSR Academy of Sciences, "Approximation Approach in Three-Dimensional Problems of Quantitative Interpretation of Gravity Anomalies"]

[Abstract] In connection with the general problem of defining and describing new classes of possible solutions of the inverse gravitational problem, families of three-dimensional field sources are being formed; these are in essence unknown to the theory and practice of gravimetric prospecting and are based on the idea of description of the distribution of densities of sources by continuous functions from classes having "good" (in some sense) approximation properties. Adopting the general concept of an approximation approach in the solution of inverse problems as the fundamental idea, within the framework of the introduced classes of field sources the author shows that it is possible to formulate a quite universal model for the quantitative interpretation of gravity anomalies using the approximation approach suggested by V. N. Strakhov in GEOFIZICHESKIY SBORNINK AN UkrSSR, Vol 62, Kiev, 1974. Then, applying further work by V. N. Strakhov, et al. in IZV. AN SSSR, FIZIKA ZEMLI, No 4, 1975, the author illustrates the essence of the method for solving three-dimensional inverse problems in the example of computing a system of harmonic moments of gravitating masses.

[227]

MECHANISM OF RECENT MOVEMENTS OF EARTH'S CRUST

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY, GEODEZIYA I AEROFOTOS"YEMKA in Russian No 6, 1976 pp 9-15

[Article by A. T. Zverev, Moscow Institute of Geodetic, Aerial Mapping and Cartographic Engineers, "On the Problem of the Mechanism of Recent Movements of the Earth's Crust"]

[Abstract] General movements of the earth's crust with a duration $\sim n \cdot 10^8$ years transpire under the influence of a unified planetary mechanism evidently having a convective nature. Movements of the earth's crust with periods of $n \cdot 10^4 - 10^7$ years are caused for the most part by the mechanism of increasing and decreasing density of matter in the earth's mantle and crust. The quasiperiodic nature and lesser rate of recent vertical movements relative to horizontal movements are related to the action of isostatic processes superposed on primary tectonic processes.

[41]

REVIEW OF STATUS OF GRAVIMETRIC MEASUREMENTS FOR GEODETIC PURPOSES

Moscow GEODEZIYA I KARTOGRAFIYA in Russian No 1, 1977 pp 16-28

[Article by M. Ye. Kheyfets, "Development of Gravimetric Measurements for Geodetic Purposes"]

[Abstract] The following subjects are considered: some peculiarities of gravimetric measurements, absolute pendulum measurements, method of relative measurements, modern pendulum apparatus, other dynamic instruments, static gravimeters, ground gravimeters, sea gravimeters, bottom gravimeters, ballistic gravimeters, present status of control networks and standard bases, gravimetric survey of the seas, oceans and shelf, and future possibilities of development of survey equipment. The author notes that at the present time a fundamental change is taking place in the direction of development of apparatus and methods for a gravimetric survey. This is attributable to the fact that relative measurement methods are incapable of giving reliable and complete information on changes in gravity with time. Therefore, the principal task in the development of gravimetric apparatus in the immediate future will be the creation of highly precise ballistic gravimeters or other instruments for absolute measurements. With the improvement of new equipment there must be a gradual changeover to usage of ballistic gravimeters for the determination of first-order control points and then second-order points. In the long run, instruments must be created for absolute measurements of gravity at all stations, which will make it possible to dispense entirely with the present-day system of control networks and standard bases corresponding to the relative determinations method. However, in the next few years there will be continued improvement of static gravimeters and pendulum instruments. Equally important is a substantial increase in the accuracy of sea measurements of gravity and its approach to the accuracy of land determinations. There is a need for improving methods for the filtering of useful signals and improving gyrostabilization apparatus. The latest advances in quantum mechanics and physics will ensure the possibility of further progress in gravimetry with an effectiveness which only recently seemed improbable.

[297]

JOINT INTERPRETATION OF AERIAL AND SPACE PHOTOS OF GEOLOGICAL FORMATIONS

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY, GEOLOGIYA I RAZVEDKA in Russian No 11, 1976 pp 69-76

[Article by D. M. Trofimov, Ye. N. Zotova, V. M. Izrailev, V. V. Kozlov, M. I. Naumov, S. N. Nikitin and O. T. Khlystova-Krotkova, Moscow State University, "Preliminary Results of a Joint Geological Interpretation of Aerial and Space Photographs of the Central Part of the Oksko-Tsninskiy Arch"]

[Abstract] In the course of field and office investigations and during aerial-visual observations the authors studied the geological information content of space photographs and also multizonal and radar aerial photographs for the central part of the Oksko-Tsnninskiy arch. It is shown that for analysis of deposits under a vegetation cover the most informative range is 0.658 and 0.683 μm . There is a change in tone of the grass cover on different types of Quaternary deposits and there is clear recognition of different species of forest vegetation. For example, on the basis of phototone and the nature of structure it is easy to discriminate pine forests, for the most part associated with sandy formations of eolian origin. Space photo surveys give material primarily on tectonics: general regionalization characteristics, structures and their interrelationships and lineaments. Local structures are reflected on photos if they are clearly expressed in the relief and landscape. The existence of a definite correspondence between lineaments and flexures indicates the reliability of the tectonic nature of the discriminated lineaments. A radar survey makes it possible to detect primarily tectonic features: dislocations and structures reflected in the relief, lithological composition of the rocks and vegetation indicators with increased scattering properties. This makes it possible to use radar images in the mapping of some lithological rock varieties. A multizonal survey is most effective in the mapping of Quaternary deposits and bedrock of forested regions by means of soil and vegetation indicators. In the geological study of platform regions covered with a mantle of surface deposits and with a considerable masking role of the vegetation cover each of the employed methods has its peculiarities in revealing geological structure. In such regions it is therefore necessary to use aerial and space photos obtained in different parts of the spectrum. Such work will make it possible to create keys for interpretation of geological formations. [259]

SPACE PHOTOS USED IN INTERPRETING STRUCTURE OF BUZACHI PENINSULA

Moscow IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY, GEOLOGIYA I RAZVEDKA in Russian No 11, 1976 pp 99-104

[Article by P. V. Florenskiy, A. N. Rudnev and V. P. Kryuchkov, Geological Institute USSR Academy of Sciences and Moscow Institute of the Petrochemical and Gas Industry, "Refinement of the Internal Structure of the Buzachi Peninsula Using a Complex of Space Photographs"]

[Abstract] The Buzachi Peninsula was photographed from several spacecraft. It was found that most of the local structures are reflected on the space photos. This has made it possible to compile a new map of the region prepared on the basis of geophysical data, made more detailed and supplemented by faults ascertained from space photographs. In addition, a table was prepared listing each particular geological structure and feature in the area and its characteristics and strike as indicated on the space photographs. [259]

USE OF INTERMEDIATE-SCALE SPACE PHOTOGRAPHS FOR GEOLOGICAL MAPPING

Moscow IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY, GEOLOGIYA I RAZVEDKA in Russian No 11, 1976 pp 117-128

[Article by A. V. Sadv and A. L. Revzon, All-Union Scientific Research Institute of Hydrology and Engineering Geology, "Results of Use of Intermediate-Scale Space Photographs for Engineering Geology Mapping (in the Example of the Central Ustyurt)"]

[Abstract] The investigations reported in this paper demonstrate the feasibility of using intermediate-scale space photographs for engineering geology mapping. This increases the quality of the product due to the excellent overview and the optical generalization of space photoimages, making it possible to define regional patterns of engineering geology complexes, map engineering geology complexes and carry out regionalization in a far shorter time than when using ordinary aerial photographs. An important advantage of space photographs is the possibility for a more thorough evaluation of the role of structural-tectonic factors in the formation of engineering geology conditions. The diagrammatic maps compiled on the basis of an interpretation of space photographs ensure a purposeful implementation of further surface work in an engineering geology survey. For checking the results of interpretation of space photographs it is necessary to carry out a complex of surface investigations in key sectors and with field interpretation of aerial photographs. Four maps accompany the text: structural-tectonic map of the Central Ustyurt, recent exogenous processes and phenomena in the Central Ustyurt (based on intermediate-scale space photographs), Quaternary deposits and geomorphological elements (based on the same photographs), engineering geology regionalization (combined space and surface investigations).

[259]

DISLOCATIONS IN WESTERN-CENTRAL ASIA

Moscow IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY, GEOLOGIYA I RAZVEDKA in Russian No 11, 1976 pp 54-64

[Article by V. G. Trifonov, Geology Institute USSR Academy of Sciences, "Late Quaternary Dislocations of Western and Central Asia Using Data from Interpretation of Aerospace Photographs and Ground Observations"]

[Abstract] This paper is devoted to a systematization and analysis of data on Holocene-Late Pleistocene movements along major faults in the southern part of the USSR and in adjacent territories. These tectonic movements are detected on the basis of displacements of Quaternary deposits and relief forms. The methods for detecting and interpreting such displacements are described in the literature. The best method for studying recent movements

of the earth's crust is a combination of aerospace and aerial methods and ground methods. Using space photographs it is possible to determine zones of possible distribution of recent deformations. Their study on aerial photographs makes it possible to discriminate specific dislocations and sectors where they can best be investigated by ground methods. A figure in the text shows major faults in this region active in the Late Pleistocene and Holocene. The text incorporates data from the 54 bibliographic sources listed. It should be emphasized that the article does not deal with space, ground or aerial surveys, but instead is a cataloguing of the regional dislocations and comments concerning them.

[259]

CLASSIFICATION OF INTERPRETATION CRITERIA FOR GEOLOGICAL FEATURES

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY, GEOLOGIYA I RAZVEDKA in Russian No 11, 1976 pp 105-108

[Article by Ya. G. Kats and M. L. Kopp, Moscow State University, "Classification of Interpretation Criteria for Geological Features in Remote Investigations"]

[Abstract] The authors propose a classification for the interpretation of geological features when using aerospace photographs. It provides for the division of interpretation criteria into two principal groups. The first of these reflect the properties of features which can be conveyed by a photograph, specifically, the optical characteristics (color, phototone, and in the case of multizonal and spectrozonal surveys, the spectral brightness) and geometrical (form, dimensions, geometric structure). The second-group criteria reflect the specific geological-landscape peculiarities of features necessary for clarification of the nature of the latter and therefore are described by the corresponding categories of geological and geographic disciplines (geomorphological, stratigraphic criteria, etc.). Depending on the analytical method, the special criteria can be inductive and deductive. Each specific geological feature has its set of inductive diagnostic criteria. Inductive criteria are necessary and adequate for an unambiguous determination of geological features. However, the sphere of their applicability is limited because by no means all the peculiarities of geological features can be transmitted photographically. In such cases it is necessary to have recourse to deductive criteria. The inductive and deductive criteria are discussed. The proposed classification reflects only the principal groups of interpretation criteria and in the future the classification must be made more detailed.

[259]

REFINEMENT OF SATELLITE ORBIT USING SPACE PHOTOGRAPHS

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY, GEODEZIYA I AEROFOTOS"YEMKA in Russian No 5, 1976 pp 75-80

[Article by M. S. Urmayev, Moscow Institute of Geodetic, Aerial Mapping and Cartographic Engineers, "Differential Refinement of the Orbit of an Artificial Planetary Satellite Using the Results of Photogrammetric Processing of Space Photographs"]

[Abstract] The article gives a method for refining the orbit of a planetary satellite using the tools of space photogrammetry. The author obtains an elaborate solution of the formulated problem, using the orienting angles of the photographic base as the values to be adjusted.

[261]

STRUCTURAL GEOLOGY INTERPRETATION OF SPACE PHOTOGRAPHS

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY, GEOLOGIYA I RAZVEDKA in Russian No 11, 1976 pp 65-68

[Article by D. G. Rikhter, "Aerogeologiya" Scientific-Productive Combine, "Structural Geology Interpretation of Photographs Taken from the 'Meteor-18' Artificial Earth Satellite in the Ustyurt Region and Adjacent Territories"]

[Abstract] In poorly dissected regions covered by sedimentary deposits, such as in the Ustyurt the principal indicator of tectonic forms is relief. On TV photographs the principal criterion for the interpretation of relief is phototone and the image pattern. Comparison of the results of interpretation with geological-tectonic materials will make it possible to detect interrelationships between the structure of a region and the photone of a photograph. The phototone plays an important role in the process of interpretation of TV photographs and is a direct interpretation criterion for the natural landscape. Among the natural landscape elements on TV photographs it is always possible to recognize directly on the basis of direct interpretation criteria both hydrographic features, on the basis of phototone, and relief forms, on the basis of the tonal structure of the phototone. For example, a terrain sector can be shown either by a uniform phototone (water, salt) or by a nonuniform tone with weak hues, with indicators of granularity, striation, spottiness, etc. In the interpretation process it is possible to discriminate two types of combinations of phototones: 1) landscapes in whose structure there is one dominant phototone, and against its background there are small sectors of a different phototone; landscapes of this group are developed on a relatively uniform geological base; 2) landscapes characterized by a complex structure. For these there

are several different varieties of phototones which form a complex mosaic. A mosaic of phototones arises where there is a complex microrelief. Thus, by knowing the distribution of landscape elements, taking into account direct and indirect criteria and using additional materials, it is possible to proceed to an interpretation of the structural geology. The results of the interpretation presented in this paper make it possible to recommend the use of super-small-scale TV photographs for the regionalization of structural geology in large areas.

[259]

APPEARANCE OF SPURIOUS ANOMALIES ON SPACE PHOTOGRAPHS

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY, GEOLOGIYA I RAZVEDKA in Russian No 11, 1976 pp 149-154

[Article by A. G. Ryabukhin, O. I. Kharlova and D. A. Kutukov, Moscow State University, "Possibility of Appearance of Spurious Anomalies on Space Images"]

[Abstract] The appearance of spurious linear anomalies on space photographs is associated with the superposing of random fluctuations. The different reflectivity of features during displacement sometimes leads to signal distortion. These distortions can be regarded as a result of the superposing of random noise. The randomness of the fluctuations is caused by the spatial and temporal variability of the conditions for the reflection and reception of fluctuations and the interference of many waves caused by the complexity of the earth's structure. The process of these fluctuations is so complex that it is impossible to take all the noise into account; it can be described only by averaged characteristics. Passing through the atmosphere, whose optical properties change with time, the reflected signal enters into the receiver, having a rigid directivity characteristic. Therefore, the received image differs from the true object because some distorting system has participated in its formation. Accordingly, with summation of the reflected signal from an area its regularization occurs and spurious linear elements can arise and the greater the level of generalization, the greater will be the probability of appearance of these signals. The direction and length of the spurious lineaments is dependent on the parameters of the survey, the investigated feature and the optical properties of the atmosphere. Therefore, the results of interpretation of space images must be carefully checked by other methods.

[259]

GEOLOGICAL STRUCTURE OF MARTIAN SURFACE

Moscow GEOTEKTONIKA in Russian No 1, 1977 pp 43-51

[Article by A. L. Sukhanov, Geology Institute USSR Academy of Sciences, "Characteristics of the Geological Structure of a Sector of Mars Surveyed by the 'Mars' Automatic Stations"]

[Abstract] A study was made of the stratigraphy and tectonics of a sector of Mars with an area of about 4,500,000 km² in the region 10-45°S and 10-80°W on the basis of photographs taken by the "Mars" automatic stations. The detailed analysis covers such subjects as morphological regionalization, crater plain, cordillera, lavas, covering surface materials, landslips and talus, eolian accumulations, craters and volcano craters and tectonics, followed by the author's hypothesis of the history of development of the planet. A large fold-out map shows all the mappable features interpreted from the space probe photographs. A comparison of the Earth, Moon and Mars reveals that the three bodies have some features in common. On both the Moon and Mars there is extensive development of large circular negative structures which are clearly expressed in the relief and which are filled with covering material. On Mars this covering material is represented by lavas, undoubtedly of basaltic composition. It is not impossible that their structural analogues on the earth are major oceanic basins and deep-water depressions of marginal seas with extensive development of primitive tholeiitic volcanism in them. It is noteworthy that on the Earth and on the Moon major annular or circular depressions are frequently regions of major positive gravity anomalies, indicating a thinning or absence of upper light horizons of the crust under them and the rising of heavier mantle matter in these regions. It is not impossible that with a further study of Mars it will be possible to discover Martian "mass-cons" under major circular depressions.

[375]

STRUCTURE OF FLUCTUATIONS OF AMPLITUDES OF TELESEISMIC P WAVES

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 232, No 4, 1977 pp 794-797

[Article by I. L. Nersesov and A. V. Nikolayev, Institute of Physics of the Earth, "Temporal Change in Structure of Fluctuations of Amplitudes of Teleseismic P Waves in the Garm Prognostic Polygon"]

[Abstract] The amplitudes of seismic waves react sensitively to relatively small changes in inhomogeneities of the medium. In this study the authors investigated the vertical components of the amplitude of the first P wave registered with the SKM-3 short-period channel at the seismic stations of the Garm prognostic polygon. The investigation was based on the records of

10 strong earthquakes in the Kamchatka region during the years 1966-1973 and 22 earthquakes from the region of the Japanese islands (1971-1973). The P wave on all the records has the form of a well-defined pulse containing several extrema (peaks). The data presented in the paper show that the amplitudes of the teleseismic P waves at stations in the polygon are subject to changes with time associated with changes in the structure of horizontal inhomogeneities of the earth's crust and possibly the top of the mantle. The characteristic dimension of the horizontal inhomogeneities does not exceed 40 km; the characteristic time interval of the change in their structure is about 1,500 days. Individual earthquakes in the region cause relatively rapid and strong changes in the field of fluctuations of amplitudes which can be partially restored some time after the earthquake.
[287]

PROCEDURES FOR GEOLOGICAL-GEOPHYSICAL REGIONALIZATION

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ZEMLI in Russian No 2, 1967
pp 95-99

[Article by W. Mundt, "Possibility of Geological-Geophysical Regionalization"]

[Abstract] There are two possibilities for the regionalization of some sector of the crust. The first assumes obtaining definite statistical characteristics whose variations serve as a basis for regionalization. Another possibility for regionalization is by the dividing of the investigated region into uniform "sets," the limits of which are defined on the basis of a study of the discontinuity of distributions of fields or criteria governed by the presence of tectonic disturbances, deep faults or lineaments. The article describes and illustrates the practical use of these two possibilities. An example of regionalization exclusively on the basis of one distribution of criteria is the distribution of the predominant directions of magnetic anomalies in the territory of East Germany. It is based on computation of 34 overlapping sectors. Regionalization on the basis of several distributions of criteria was carried out in a polygon on the southern boundary of the North German-Polish Lowland. It was based on maps of magnetic anomalies, Bouguer anomalies and different field transformation maps. Information on the depth range 0-50 km was used. In the analysis the correlations between field distributions were used, not the observed values themselves. For each sector there were 15 criteria used in computing the matrix of differences of the vectors of criteria and the correlation matrix. It was found that regionalization on the basis of a correlation matrix corresponds better to the real regional geological situation than a division obtained using the vectors of criteria. An example of determination of the limits of regions by complex correlation analysis on parallel profiles is also given.
[352]

DETERMINING PHASE VELOCITIES OF SEISMIC WAVES

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ZEMLI in Russian No 12, 1976
pp 80-83

[Article by A. Kiyko, Moscow State University, "Determining Apparent Phase Velocities of Seismic Body Waves"]

[Abstract] An attempt was made at precise determination of the arrival times, apparent phase velocity and the duration of "trains" in seismic waves by use of the Savarenskiy method. In this method there are records of one and the same earthquake for two seismic stations situated at approximately the same azimuth from the epicenter. The accuracy in determining the apparent phase velocity is dependent on the correctness of wave identification and the accuracy in reckoning arrival time. Correlation of phases directly on the basis of seismograms is usually impossible and therefore it is first necessary to carry out digital filtering with suppression of the high-frequency oscillations. In addition, in the case of registry by seismographs with significantly different phase characteristics it is necessary to introduce corrections for the instrument phase shift. The approach taken by the authors is illustrated using data for two deep-focus earthquakes with epicenters in the Sea of Okhotsk. Digital filtering was used with the frequency characteristic of the filter being taken in the form of a trapezium. An important property of this filter was the clarity of its frequency characteristic, as a result of which the filter does not introduce phase shifts and does not distort the phase characteristics of the oscillations filtered by it.

[229]

ESTIMATING DENSITY OF INTERMEDIATE LAYER FROM GRAVIMETRIC DATA

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ZEMLI in Russian No 12, 1976
pp 99-104

[Article by Yu. F. Tkachenko, Ivano-Frankovskiy Institute of Petroleum and Gas, "Statistical Evaluation of Density of the Intermediate Layer Using Gravimetric Data"]

[Abstract] There are several analytical methods for computing the density of the intermediate layer. The statistical approach must be regarded as the best. It is usually assumed that the measurement errors conform to a Gaussian law. In this case the most appropriate processing method is the least squares method. The author of this article earlier proposed a correlation method for determining density of the intermediate layer in which there is no superposing of any significant limitations on the law of distribution of errors. Experience in gravimetric investigations shows that for evaluating density small samples are used. Each sample usually has its

own error distribution law which in each specific case can be close to the normal law or the Laplace law. There are samples containing individual blunders greatly exceeding the random component. In accordance with the law of distribution of errors, there should also be a change in the computation schemes for obtaining evaluations. When the measurement errors conform to a Laplace distribution, the best processing method is the so-called least moduli method. Under still other circumstances, the correlation method is most effective. It is shown in this article that it is possible to devise a system in which it is easy to ascertain which of the alternative processing methods is most appropriate.

[229]

ISOSTASY AND VERTICAL CRUSTAL MOVEMENTS ON MONERON ISLAND

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 232, No 5, 1977 pp 1043-1045

[Article by Corresponding Member USSR Academy of Sciences S. L. Solov'yev, Yu. A. Pavlov and L. S. Oskorbin, Sakhalin Multidiscipline Scientific Research Institute, "Isostasy, Slow Vertical Movements of the Earth's Crust and the Strong Earthquake of 1971 on Moneron Island"]

[Abstract] The region of Moneron Island, adjacent to the southwest extremity of Sakhalin, is characterized by a considerable impairment of isostasy of the earth's crust. On 6 September 1971 the southwestern part of Sakhalin was affected by a strong earthquake. The most intensive tremors were observed on Moneron Island. Study of the focal mechanism indicated that the Moneron earthquake was a result of an upthrust and southwestward shift of a crustal block; crustal movements in the course of the earthquake were in the direction of a further impairment of isostasy. It is clear that the continuing rising of the crust in accordance with the overall direction of vertical movements in recent times in this region is occurring in the form of sharp jumps causing earthquakes. On the other hand, during a period of attenuation of the corresponding tectonic forces there are slow movements of the crust in the direction of a restoration of equilibrium.

[288]

V. UPPER ATMOSPHERE AND SPACE RESEARCH

News

"SNEG-3" UNDERGOES TESTS

Moscow PRAVDA in Russian 17 Apr 77 p 6

[TASS Report: "Under the Cooperation Program"]

[Text] At the Space Research Institute USSR Academy of Sciences the French scientific satellite "Sneg-3" is undergoing tests. The satellite will be launched into orbit using a Soviet rocket. The instruments installed on the satellite will be used to study roentgen and gamma radiation originating in space and will also be used to observe the sun in the UV spectral range. The launching of this satellite will be one of the stages in the Soviet-French study of gamma bursts. They are planning to do this with several space vehicles within the limits of long-range cooperation between the two countries in the field of gamma astronomy. A group of French specialists has arrived in Moscow for the tests of the "Sneg-3." [5]

NEW SPACE COMMUNICATION STATION IN BULGARIA

Moscow PRAVDA in Russian 16 Apr 77 p 4

[TASS Report]

[Text] A space communication ground station is being constructed near Sofia with technical help from the Soviet Union. When the station becomes operational it will bring the People's Republic of Bulgaria into the "Intersputnik" international communication system and will enable Bulgaria to exchange radio and television programs with countries which are participants in this international organization of socialist countries. [A photograph shows the antenna of this space communication station.] [5]

TASS ANNOUNCES LAUNCHING OF "KOSMOS-904"

Moscow PRAVDA in Russian 21 Apr 77 p 1

[TASS Report: "'Kosmos-904' in Orbit"]

[Text] The artificial earth satellite "Kosmos-904" was launched in the Soviet Union on 20 April 1977. The satellite carries scientific equipment intended for the continuation of space research. The satellite was inserted into an orbit with the following parameters:

- initial period, 89.8 minutes;
- apogee, 150 kilometers;
- perigee, 210 kilometers;
- orbital inclination, 71.4 degrees.

In addition to the scientific equipment, the satellite carries a radio transmitter operating on a frequency of 19.995 MHz, a radio system for the precise measurement of orbital elements and a radiotelemetry system for transmitting data on the operation of instruments and scientific equipment to earth.

The apparatus installed on the satellite is functioning normally. The coordination-computation center is processing the incoming information. [5]

SPACE PHOTOGRAPHY USED FOR AGRICULTURAL FORECASTING

Moscow GUDOK in Russian 8 April 77 p 1

[Unsigned article: "The Harvest is Predicted from Space"]

[Text] Baku. Scientists at the "Kaspiy" scientific center of the Azerbaydzhan SSR Academy of Sciences have completed the first stage of research on application of aerospace techniques to solving problems in agricultural production.

The Azerbaydzhan scientists are performing this work jointly with scientists of the Space Research Institute USSR Academy of Sciences. Commenting on the results of this work, T. Ismaylov, Director of the "Kaspiy" center, reported that the principle of comparison of ground data with aerospace photographs is used as the basis of this experiment in forecasting crop yield. Studies were made of characteristic changes occurring at various stages in the development of cotton, especially after the application of agricultural measures. This methodology makes it possible to evaluate and take stock of natural resources with considerably greater speed and accuracy. [4]

NOTES ON COMMUNICATION WITH EXTRATERRESTRIAL CIVILIZATIONS

Moscow NAUKA I ZHIZN' in Russian No 6, 1976 pp 63-65

[Article by R. Svoren', "Speculations With Hope"]

[Abstract] At the Moscow House of Scientists there was recently a meeting with a group of scientists who told of different aspects of the problem of establishing contacts with extraterrestrial civilizations. Flier-Cosmonaut V. Sevast'yanov noted that during his spaceflight there were no evidences of extraterrestrial life; he also noted that American astronauts likewise failed to observe anything suggesting such life [despite rumors that they had]. A probabilistic approach to the question as to whether extraterrestrial civilizations exist was applied long ago, but unfortunately, during recent years nothing has happened which would make possible a more precise computation of the probability of the existence of reasoning life in the universe. It was noted that the progress in exoatmospheric astronomy can answer the question as to how frequently stars have planetary systems. Only one astronomer has reported the discovery of a star with a planetary system. And this is in the doubtful category. If it were possible to put a telescope with a mirror diameter of more than 2 m beyond the limits of the earth's atmosphere, it would be possible to see directly whether many stars in our microregion of the Galaxy have planets. One of the principal reports at the meeting was by N. Kardashov, a scientific specialist at the Space Research Institute. He told of attempts to pick up radio signals from other planets. Such attempts have been long ago undertaken in different countries using different radioastronomical systems and instruments. But the system which he described merits special attention. It was created specially for monitoring cosmic ether, in order to seek out ordered signals in space which with a high probability could be attributed to an extraterrestrial civilization. The basic idea is to use several receivers operating in the centimeter range, situated at very great distances from one another. For the time being three such receiving centers have been established: in the Caucasus, on Kamchatka and in the Pamirs. All the receivers operate synchronously and a signal is not considered to be received unless it has arrived simultaneously at all three receivers. And if a "rational" signal is received in such a spaced receiving system, it can be said with assurance that it is of nonterrestrial origin.

[280]

SPACE PHOTOGRAPHS USED TO LOCATE NATURAL RESOURCES

Moscow IZVESTIYA in Russian 1 March 77 p 2

[Article by USSR Pilot-Cosmonaut G. Beregovoy, Director of the Cosmonaut Training Center, and Yu. Kiyenko, Director of the State Scientific Research and Production Center "Priroda"]

[Summary] The list of specific examples of study of natural resources with the use of space vehicles is becoming longer and longer. A distinguishing characteristic of Soviet programs for space sounding of natural resources is careful planning, step-by-step solution of complex scientific and technical problems. An example is the development of one of the promising directions in the collection of information on natural resources -- a multizonal survey. The world's first experiment with multizonal photography was carried out aboard the "Soyuz-12" and the photographic materials returned revealed the broad possibilities of the use of images in narrow spectral zones. Using these photographs it was possible to refine the geological structure of a large region, petroleum- and gas-bearing structures were discovered and it was possible to define territories with fertile soils. More effective multizonal apparatus was carried aboard the orbital station "Salyut-4" and was used in making a survey in different parts of the spectrum over considerable areas in the southern part of the country. The collected information became available to more than 300 organizations, including 150 scientific research organizations, 166 planning-research institutes and 26 colleges. New equipment created by specialists in the USSR and the GDR functioned successfully aboard the "Soyuz-22." The branch use of space information for investigations of natural resources is even now yielding practical results. There have been important achievements in the field of study of the earth's deep layers, forest resources, engineering research, mapping, etc. However, the greatest effect can be expected from the combined use of space information for the multibranch study of natural resources. Surveys from space will make it possible to raise to a new scientific and technical level observations of the dynamics of natural processes. The use of space photographic surveys and the results of soundings in other ranges of the spectrum of electromagnetic radiations will make it possible to carry out investigations of natural processes and phenomena: impairments in the ecological balance, state of internal water bodies, nature of land use, development of soil erosion processes, changes in the water supply of high-mountain glaciers, dynamics of the boundaries of deserts, swamps, and taiga, trends in the development of forest productivity, pastures, etc. The time has come when it is necessary to devote proper attention to the training of personnel; introduction into the curriculum of appropriate colleges of courses on remote sensing of the earth is required. Only through the joint efforts of many branches of the national economy will it be possible to accomplish a transition from research and experimental-production work to the industrial use of space methods for the study of natural resources and the environment.

[334]

IR MEASUREMENTS FROM SPACE ABOARD THE "SALYUT-5"

Moscow PRAVDA in Russian 8 Mar 77 p 2

[Article by M. Markov, "In the IR Range"]

[Summary] In contrast to the ITS-K instrument, the apparatus carried aboard the "Salyut-5" can operate not only under the control of the cosmonauts, but also in an automatic regime. This is a universal, long-functioning system. A mirror telescope with a diameter of 0.3 m here is combined with an IR scanning spectrometer and is placed in a niche in the vehicle outside the station compartment. The radiation detector used is a low-inertia instrument for measuring radiant energy -- a bolometer. This makes it possible to carry out investigations in a broad spectral region and the absence of cooling systems does not impose restrictions on the lifetime of the apparatus. An important object of the investigations on the station is the sun. The spectra contain information on such molecules in its atmosphere as carbon monoxide, cyanide, etc. They exist in the relatively cold solar photosphere and can give information on processes of energy transfer from the internal zones outward -- into the chromosphere and corona. In this experiment the precise pointing of the telescope was carried out by the crew. Another experiment on the "Salyut-5" involved so-called small components, primarily water vapor, carbon monoxide and ozone. It is important to study the distribution of these gases at altitudes 25-100 km above the earth. The cosmonauts registered the transmission spectra of water vapor, nitric oxide, carbon monoxide and other components. When carrying out this experiment the cosmonauts controlled the station in such a way that its axis was at all times directed toward the sun. The cosmonauts obtained more than a thousand spectra of a high quality for different levels in the atmosphere in eight regions -- in the North Atlantic, in the Pacific Ocean and in the Far East. In the spectra it is possible to trace the absorption bands of water at altitudes from 15 to 70 km. The cosmonauts handled the task well and the dynamic possibilities of the "Salyut-5" with precise pointing of the telescope at the sun and the prolonged holding of its images on the spectrometer slit exceeded all expectations. In the gap between cosmonaut visits to the station, the IR telescope-spectrometer in an automatic regime registered the radiation of the moon, earth and circumterrestrial space and was used in investigating the optical characteristics of the lunar surface and solar-terrestrial relationships. The design of the telescope-spectrometer makes it possible to study fluxes differing in intensity by billions of times. In December 1976 this made it possible to carry out measurements of the emission spectra of IR sources in the large nebula Orion, in which the process of generation of novae is occurring. The superb qualities of the new IR apparatus have been demonstrated. The low-inertia bolometer fabricated at the Leningrad Optical-Mechanical Combine, constituting an important component of the complex, is the best instrument of this class in the world.

[355]

COMMENTARY ON "KOSMOS" SATELLITE MISSIONS

Moscow PRAVDA in Russian 3 Apr 77 p 3

[Article by K. Gringauz, USSR Space Research Institute, and B. Tverskoy, Nuclear Physics Institute Moscow State University, "Laboratory in the Magnetosphere"]

[Summary] At an altitude of about 10,000 km above the earth there is an electric field which sharply accelerates electrons and therefore their energy near the earth increases considerably. The injection of electrons into the atmosphere causes auroras, exerts an influence on the properties of the ionosphere and considerably disturbs the earth's magnetic field. The intensity and position of these currents frequently change during so-called magnetospheric substorms which seriously impair radio communication in the high latitudes. Simultaneously there is a replenishment of the radiation belts by protons and high-energy electrons. Auroras are one of the most clear manifestations of a unified complex of electromagnetic and plasma processes in the magnetosphere. It has now been established that similar processes, but on considerably greater scales, transpire near Jupiter. And they play an important role in the development of solar flares. That is why the substorm problem is of particular interest with respect to fundamental investigations and also for practical purposes. During the years 1976-1978, under the program for international investigations of the magnetosphere, scientists of many countries will carry out experiments using a series of artificial satellites and a network of ground stations. In order to obtain the most complete picture of the processes of interest to scientists it will be necessary to have three "levels" of satellites. Satellites of the "Prognoz" series spend a considerable part of their time in the "solar wind" and make it possible to investigate its interaction with the earth's magnetic field. Using the instrumentation carried aboard the "Molniya" satellites, studies are made of the properties of the ring current. Finally, low-flying satellites with a polar orbit are used for learning about magnetospheric-ionospheric interactions. This will be the purpose of the "Kosmos-900" satellite, launched on 30 March. Its instrumentation will make it possible to measure the characteristics of cold ionospheric plasma, fluxes of auroral and radiation belt electrons and protons, and also to register from above a number of characteristic spectral ranges of auroras in the UV and visible regions of the spectra. This instrumentation has been fabricated by scientists of the USSR, East Germany and Czechoslovakian SSR.

[6]

REPORT ON "SALYUT-5" SYSTEMS

Moscow IZVESTIYA in Russian 11 Feb 77 p 2

[Article by B. Konovalov, "Perpetual Engine for Space"]

[Summary] After Boris Volynov and Vitaliy Zholobov left the "Salyut-5," the station at all times to the arrival of Viktor Gorbalko and Yuriy Glazkov, a period of more than five months, remained in a constant triaxial orientation for the most part by means of the electromechanical system aboard. One station axis was always directed to the center of the earth and a second was oriented along the tangent to the flight orbit. And the "Salyut-5" revolved around the planet in such a regime. On the Soviet "Meteor" satellites this sort of orientation is maintained by means of three flywheels. Each of these can "parry" a perturbation. The "Salyut-5" has a more effective and clever system. Its "heart" is a special sphere "floating" at a definite distance from the walls of the body of the vehicle on a "magnetic suspension." A system of six electromagnets, by means of sensors tracking its position, holds the sphere in "magnetic weightlessness" and by means of other electromagnets it can be rotated without losses in friction. The electromechanical system operates without a single bearing. If the station is deflected from its stipulated position, the magnitude of this deviation is determined from the readings of the sensors by a special computer and a system of commands is produced for the direction and speed by which the sphere must be rotated in order to restore the orientation. A sphere with a diameter of about 60 cm weighs a little less than 100 kg, whereas the "Salyut"- "Soyuz" system weighs 25 tons. But since the sphere spins at a speed of a hundred revolutions per minute, the forces of "reaction" to this mad rotation are entirely adequate for the orbital station to be turned slowly in the necessary direction. The "reaction" is transmitted to the station through the body in which the sphere rotates. If the station must be turned rapidly along the flight trajectory, it is possible to use a uniaxial flywheel in the form of a ring with a large diameter. This has a more powerful kinematic moment than the sphere. The "fuel" for such a system is the electric current produced by solar cells, and since the sun is an inexhaustible energy source, the electromechanical system can operate "eternally." This sort of system will be used extensively on stations designed for operation with exchangeable crews.

[244]

ACADEMICIAN SPEAKS ON SPACE EXPLORATION COOPERATION

Moscow PRAVDA in Russian 13 April 1977 p 3

[TASS Report: "In the Name of Progress"]

[Summary] A solemn meeting of representatives of the workers of Moscow and soldiers of the capital garrison, devoted to Cosmonautics Day, was held on 12 April in the Central Theater of the Soviet Army. The main address was presented by Academician B. N. Petrov. He noted that it is difficult to overestimate the importance of orbital stations for the progress of science and technology and for solution of many problems in the national economy. The extensive work program for orbital stations provides for investigations in the field of exoatmospheric astronomy, study of the earth

and the earth's atmosphere from space, investigation of physical processes and phenomena in space, and also technological experiments in weightlessness, biomedical investigations, tests of on-board systems and apparatus. Work is proceeding successfully on study of the moon and planets of the solar system. These investigations are important for a better understanding of the nature of the earth, its climate and processes transpiring on it. In the past year work continued on the processing of the enormous volume of information obtained on the flights of the "Venera-9" and "Venera-10." On 22 August of the past year the "Luna-24" returned to earth samples of lunar ground taken from a depth of more than two meters. For the purpose of further development of space television broadcasting, during the past year the USSR launched into stationary orbits communication satellites of the new "Raduga" and "Ekran" types. The "Ekran" is already being used for high-quality transmission of color programs from Central Television for the territory of Siberia and the Far North. Academician Petrov told in detail about successfully developing cooperation in the exploration and use of space. A major step in the development of international cooperation was the flight in September 1976 of the spaceship "Soyuz-22." It carried the MKF-6 multizonal camera developed by specialists of the USSR and East Germany and fabricated at the People's Enterprise "Karl Zeiss Jena" in East Germany. During the past year in Moscow there were discussions among delegations of the socialist countries which are participating in the "Interkosmos" program. There was discussion of the proposal by the USSR that during 1978-1983 the citizens of Bulgaria, Hungary, East Germany, Cuba, Mongolia, Poland, Rumania and Czechoslovakia might participate in the manned flights of Soviet spaceships and stations. The proposal was adopted and in December of last year the first group of cosmonaut candidates, citizens of Czechoslovakia, Poland and East Germany, undertook training at the Cosmonaut Training Center. Soviet-Indian cooperation in space is continuing, particularly with respect to the creation of a second Indian satellite, which is to be launched from the territory of the USSR in 1978. (using a Soviet carrier-rocket). The satellite will carry instruments for studying the earth's natural resources. In cooperation with France, plans call for use of a Soviet carrier-rocket to launch the French satellite "Sneg-3," to be used in the field of gamma astronomy. Soviet-Swedish space cooperation is also developing successfully. With the United States, there are discussions of further Soviet-American cooperation in the field of international manned flights.

[33]

Abstracts of Scientific Articles

"SALYUT-4" DETERMINATION OF IR SPECTRUM OF NITRIC OXIDE

Moscow KOSMICHESKIYE ISSLEDOVANIYA in Russian Vol 15, No 1, 1977 pp 125-128

[Article by M. N. Markov, G. M. Grechko, A. A. Gubarev, Yu. S. Ivanov and V. S. Petrov, "Registry of the IR Spectrum of Nitric Oxide in the Middle-Latitude Upper Atmosphere from the 'Salyut-4' Orbital Scientific Station"]

[Abstract] Experimental determination of the emitting component of the upper atmosphere and measurements of its emission intensity was one of the uses of the ITS-K infrared telescope-spectrometer aboard the orbital station "Salyut-4." Observations were made on the 514th revolution of the station on 27 January 1975 at about 1800 hours Moscow time. The entire segment of observations corresponded to a motion of the station for a distance of 1,600 km. The observations made it possible to obtain the emission spectrum of nitric oxide in the middle latitudes at altitudes 140-350 km in the range $1,800-2,000\text{ cm}^{-1}$. The volume density of emission is $1.5 \cdot 10^{-6}\text{ erg/cm}^3\cdot\text{sec}$; the thickness of the emitting layer is 60-70 km.
[345]

IONOSPHERIC PROPAGATION OF RADIO WAVES

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 1, 1977 1A251

[Abstract of article by I. M. Vilenskiy, O. M. Grekhov, G. I. Kuzin, O. I. Lipay, V. I. Kim, V. M. Nesterenko and V. A. Talyshev; Novosibirsk, ISSLED. OKOLOZEMN. PROSTRANSTVA, 1976, pp 6-17, "Investigation of the Peculiarities of Ionospheric Propagation of Radio Waves in the Range About 150-1,500 KHz"]

[Text] During 1972-1975 specialists carried out investigations of the propagation of radio waves in the range about 150-1,500 KHz at nighttime at distances $\leq 500\text{ km}$ from the transmitter. For distances $> 230\text{ km}$ information on the field strength of reflected waves was obtained by processing records

of the strength of the total field of radiobroadcasting transmitters (the records are made at technical radio monitoring stations). For research at lesser distances specialists carried out experiments with pulse modulation of signals of a transmitter with specially created noise-immune receiving and transmitting apparatus. The article describes the experimental method and the apparatus; also given is a block diagram of a two-channel receiving apparatus. In a number of experiments, in addition to amplitudes and group lag, measurements were made of the phase of reflected pulses relative to the earth. Analysis of the experimental data made it possible to show that at frequencies of 1,050-1,550 KHz during reception it is common to observe several pulses reflected from different ionospheric levels, and at a frequency of 550 KHz -- most frequently one, reflected from an altitude of about 100 km. Sometimes pulses of an appreciable amplitude were observed whose group lag corresponds to great reflection altitudes (≥ 700 km); the nature of these pulses for the time being is not clear. The conclusion is drawn that the reflection mechanism is evidently single-hop, with simultaneous reflection of signals from different altitudes in the ionosphere. On the basis of data from these measurements it was possible to construct field strength curves for distances 75-600 km. In the region about 200-300 km there is some minimum whose depth decreases with $f < 100$ KHz. The authors have analyzed the statistical characteristics of amplitudes and phases of reflected signals. Bibliography of seven items.

[276]

CALCULATING AND PREDICTING RUNOFF FROM SATELLITE PHOTOGRAPHS

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 1, 1977
1V270

[Abstract of article by G. P. Kalinin, Yu. V. Kurilova and P. A. Kolosov; Moscow, PRIROD. VODY I OKRUZHAYUSHCHAYA SREDA, 1976, pp 7-16, "Some Prospects for the Development of Methods for Computing and Predicting Runoff from Photographs Taken from Artificial Earth Satellites"]

[Text] At the present time there are possibilities for creating a new precise system for the prediction of hydrological processes, the elements of which are the computed components of those methods which have undergone testing over a period of many years. The principal points in the study can be summarized as follows: 1. Direct observations of the dynamics of hydrological processes over considerable areas can considerably improve the degree of study of the processes and the accuracy of their computation; 2. The genetic runoff formula has such a general character that it can be used when employing information obtained from photographs. This will make it possible to use known apparatus for obtaining qualitatively new information; 3. The correlation between areas of flooding (surface of basin, gully-ravine and river network) and the extent of the network of intermittent

watercourses with the hydrological characteristics of these elements and the runoff of water is close to functional and the structure of this correlation can be established by relying on an analysis of observational data. 4. The different dimensions of the characteristics of the flooding of the surface of water basins and the gully-ravine and river network make it possible to use initial observational data in the computations; 5. The areas of the basin surface, covered with water, obtained from the photographs, can be represented as a result of the transpiration of runoff. This creates the possibility of avoiding the use of direct runoff factors as initial data; 6. It appears possible to restructure the present-day system of predictions and computations to another, using new information; 7. The great significance of the new forecasting possibilities will stimulate the development of new experimental research. Particular reliance must be placed on the finding and investigation of new remotely determined parameters which can newly characterize hydrological processes. The article examines three types of runoff models in which the specific forms of coverage by water are determined by remote methods. The conclusion is drawn that the fundamental possibilities now exist for a new system for the preparation of forecasts of almost all types of runoff and also its computation on the basis of use of remote data obtained from artificial earth satellites.

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POSSIBLE NATURE OF THE AURORAL E LAYER

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 17, No 1, 1977, pp 35-39

[Article by A. S. Besprozvannaya and T. I. Shchuka, Arctic and Antarctic Scientific Research Institute, "Possible Nature of the Auroral E Layer"]

[Abstract] The authors compare polar diagrams of the distribution of the auroral E layer with the peculiarities of the planetary distribution of electron and proton leakage and theoretical computations of the drift trajectories of charged particles with energies 10 keV. The analysis reveals a good agreement between the compared parameters, making it possible to conclude that the region of appearance of the auroral E layer is bounded on the polar side by the latitude of the boundary of the closed lines of force and on the equatorial side by the projection of the plasmopause onto the ionosphere. It can therefore be assumed that the source of formation of the auroral E layer is ring current protons with an energy up to several tens of keV.

[46]

SCATTERING FUNCTION FOR GREAT ATMOSPHERIC OPTICAL THICKNESSES

Moscow IZVESTIYA AN SSSR, FIZIKA ATMOSFERY I OKEANA in Russian Vol 13, No 1, 1977 pp 94-97

[Article by V. Ye. Pavlov, Astrophysical Institute Kazakh Academy of Sciences, "Determining Scattering Function for Great Atmospheric Optical Thicknesses"]

[Abstract] The determination of the function of single scattering $f_1(\varphi)$ from observations of the brightness of the daytime sky at the solar almucantar in the case of great optical thicknesses of the atmosphere involves a necessity for taking into account the angular structure of multiply scattered light. Even in the UV spectral region, in cases of an insignificant atmospheric turbidity, that is, in a case of a small asymmetry of the function due to the dominating influence of molecular scattering, neglecting of the angular dependence of multiple effects leads to incorrect $f_1(\varphi)$ values. The use of theoretical computations based on solution of the equation for transfer of radiant energy in the atmosphere for the finding of $f_2(\varphi)$ is not always justified. Therefore, the author has formulated empirical procedures giving an approximately correct dependence $f_2(\varphi)$ on the scattering angle and not requiring preliminary information on $f_1(\varphi)$. Then a procedure is given for determining the single scattering function. The proposed method for finding $f_1(\varphi)$ is used here for a case when the neglecting of the angular dependence $f_2(\varphi)$ gives an incorrect result. Allowance for the angular structure of the function $f_2(\varphi)$ leads to an increase in the absolute values $f_1(\varphi)$ in the region of large scattering angles, as a result of which they coincide (within the limits of error) with the Rayleigh component $f_R(\varphi)$.

[228]

ELECTRIC CURRENT SYSTEMS IN THE POLAR IONOSPHERE

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 17, No 1, 1977 pp 44-49

[Article by V. V. Denisenko and V. G. Pivovarov, Krasnoyarsk Computation Center, Siberian Department USSR Academy of Sciences, "Computation of Current Systems in the Polar Ionosphere"]

[Abstract] A study was made of electric fields and currents in the high-latitude ionosphere, being a result of vertical magnetospheric currents. The authors have formulated a stationary two-dimensional electrostatic model of the ionosphere; the problem is formulated mathematically. The article includes diagrams of electric fields and currents and equivalent current systems. A comparison of the results with experimental data is presented. It is clear that the solution of a whole series of important problems in ionospheric and magnetospheric physics can be reduced to solution of one and the same equation. The numerical solution algorithm presented here, with no pretense to universality, makes it possible with a sufficient degree of accuracy to describe ionospheric fields and currents in the polar cap, auroral and subauroral zones.

[46]

SEMIANNUAL TEMPERATURE VARIATIONS IN THERMOSPHERE

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 17, No 1, 1977 pp 90-93

[Article by V. N. Chepurnoy and G. A. Charina, Mechanics Institute Ukrainian Academy of Sciences, "Semiannual Temperature Variations in the Thermosphere and Their Correlation with Atmospheric Circulation and Mesospheric Clouds"]

[Abstract] The authors investigated the problem of the reasons for the discrepancy between January and July minima and April and October maxima in the semiannual variation of thermospheric temperatures. The following aspects of the problem are considered: heating by short-wave solar radiation, sources of heating associated with geomagnetic activity, heating and cooling due to infrared and visible atmospheric emissions, atmospheric circulation, ozone, mesospheric clouds. The data presented here show that the discrepancy between the January and July minima and the April and October maxima can be attributed to the process of cooling of the mesopause due to hydroxyl emission. In actuality, according to observational data, noctilucent clouds most frequently appear during the summer months (July maximum), indicating a cooling of the mesopause and accordingly a change in the general temperature distribution in the thermosphere. In other words, the semiannual July minimum caused by interaction with the solar wind is emphasized by the cooling effect of water vapor. In accordance with the presented explanation, the October maximum should be greater than the April maximum.

[46]

PROCESSES IN AURORAL PARTICLE INJECTION REGION

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 17, No 1, 1977 pp 105-109

[Article by V. S. Bassolo and N. K. Osipov, Nuclear Physics Institute, Moscow State University, and Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation, "Electrodynamic Processes in the Region of Injection of Auroral Particles"]

[Abstract] In this examination of electrodynamic processes in the region of injection of auroral particles the conclusion is drawn that charge transfer by auroral particles from the magnetosphere into the ionosphere leads: a) to the formation of a system of compensation currents whose intensity and structure in the nighttime ionosphere is completely determined by the energy characteristics of the flux of auroral particles and the geometry of the region of their injection; b) to the appearance of inhomogeneities of electron concentration in the ionosphere. The authors intend to investigate the problem further, deriving computation formulas and making numerical estimates characterizing the structure of electric fields and currents and the properties of inhomogeneities in specific geometrical models.

[46]

ELECTRIC FIELD OF AURORAL ORIGIN IN ATMOSPHERE

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 17, No 1, 1977 pp 149-151

[Article by V. K. Roldugin, Polar Geophysical Institute Kola Affiliate USSR Academy of Sciences, "Eddy Electric Field of Auroral Origin in Atmosphere"]

[Abstract] High-latitude geophysical disturbances, associated, in particular, with the appearance of the DP current system, are accompanied by electric fields registered in the ionosphere, stratosphere and in the earth. This paper is devoted to an investigation of the nonpotential part of the electric field. On the basis of the estimates cited in the article it can be concluded that the pulsating electric field in the stratosphere for the most part has a potential nature. However, in the case of small periods and great wavelengths (Pcl-3 pulsations) the intensity of the eddy field can be comparable to the potential field. In the ionosphere in the case of high integral conductivity values (auroral zone or daytime side) both types of field can be values of the same order of magnitude. Pulsations of the eddy field in phase outpace the pulsations of the magnetic field, whereas pulsations of the potential field lag behind them by a value related to charge relaxation time in the atmosphere. This circumstance can be used in the problem of separating the variable component of the electric field into potential and eddy parts.

[46]

USES OF SATELLITE MEASUREMENTS IN ASTROGEODETIC NETWORK

Warsaw GEODEZJA I KARTOGRAFIA in Polish Vol 25, No 3, 1976 pp 147-155

[Article by Janusz Sledzinski, Zbigniew Zabek, Kazimierz Czarnecki and Jerzy Rogowski]

[Abstract] Geodetic satellite measurements are yielding results useful not only in solving the basic scientific problems of geodesy such as investigations of the figure, dimensions and gravitational field of the earth and also for practical purposes of higher geodesy, contributing qualitatively new elements to the layout of astrogeodetic networks. At present, with the use of satellite methods, competitive accuracies can be obtained in comparison with those given by classical geodetic methods. This competitiveness, however, does not mean a possibility of the substitution of these methods. The methods are complementary. The authors examine in detail satellite observation techniques based on photographic, laser and Doppler methods. These permit the realization in a spatial network of three different kinds of observation: direction, range and range rate in relation to satellites. With respect to accuracy, the most advantageous method is the simultaneous use of different measurement methods. Electronic and

long-base interference techniques are expected to become of considerable importance. The authors discuss use of satellite measurements in geodetic networks and distinguish two conceptual groups: the creation of large global satellite networks based on a dozen or several dozen world satellite points (Polish project of J. D. Zagolowicz based on 13 points and the USCGS network based on 45 points and networks using both satellite and classical measurements (West European and Finnish networks). The rest of the article is devoted to a detailed discussion of the use of satellite measurements in astrogeodetic networks, possibilities of the use of dynamic satellite methods and the role of coordinate systems. It is noted that experimental work carried out at the Institute of Higher Geodesy and Geodetic Astronomy of the Warsaw Polytechnic Institute has led to the development of a laser interferometer based on a stabilized laser; this in turn has led to the undertaking of construction of a 24-m interference field comparator with an accuracy of 10^{-7} .

[361]

5577 and 6300 A LINE CONTOURS IN AURORAS

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 17, No 1, 1977 pp 153-154

[Article by V. M. Ignat'yev, Institute of Space Physics Research and Aeronomy Yakutsk Affiliate Siberian Department USSR Academy of Sciences, "Characteristics of the 5577 and 6300 A Line Contours in Auroras"]

[Abstract] Since 1972 specialists at the Polar Geophysical Observatory at Tiksi have carried out investigations of the profiles of the oxygen emission lines 5577 and 6300 A during auroras. For this purpose Fabry-Perot interferometers with photoelectric and photographic recording were used. During the measurements there were found to be some peculiarities in the profiles of these emissions. In auroras of classes II-III over a short period of time not exceeding several minutes there was an appreciable deformation of the profiles. There was a considerable broadening of the profile wings, whereas its central part did not exhibit appreciable changes. The intensity ratio also changed in a broad range. Broadening in the profile wings of the 5577 A line was by a factor of three to five in comparison with the half-width of its usual profile; for the line 6300 A the similar broadening was by a factor of three. The experiments indicate the reality of the observed deformation of the profiles of oxygen emissions caused by excitation processes in the upper atmosphere. A possible factor responsible for this effect can be the appearance in the upper atmosphere at great altitudes of fast excited $O(^1D)$ and $O(^1S)$ atoms in the process of dissociative recombination of ions of molecular oxygen. Preliminary estimates show that the observed broadenings in the wings of oxygen emission profiles correspond to energies of 0.83 and 2.79 eV, released during the recombination of ions of molecular oxygen with electrons.

[46]

SPECTROMETER FOR STUDY OF ELECTRONS IN COSMIC RAYS

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 17, No 1, 1977 pp 26-29

[Article by R. N. Basilova, S. A. Vysotskiy, A. A. Gusev, L. F. Kalinkin, G. V. Lupenko, G. I. Pugacheva, I. A. Savenko and N. M. Safronova, Nuclear Physics Institute, Moscow State University, "Spectrometer for Study of Electrons with Energies 6-50 MeV in Cosmic Rays"]

[Abstract] The "Prognoz-4" satellite carried an electron spectrometer in which together with detectors measuring dE/dx and E there was a directed Cerenkov detector with a specially shaped plexiglas radiator. This made it possible to introduce still another criterion for discriminating electrons and measuring their energy spectra by the simultaneous registry of ionization losses, Cerenkov radiation and the energy release of a particle. Figure 1 in the text is a block diagram of the spectrometer. It is made up of a telescope formed by a Cerenkov detector, semiconductor dE/dx detector and an energy scintillation detector. The telescope is placed within a protective scintillation detector which protects the telescope against lateral showers and precludes the registry of long-path particles. The block diagram serves as the basis for a detailed discussion of the individual components and their interaction. The geometry factor of the instrument is $1.2 \text{ cm}^2 \cdot \text{sr}$. The instrument weighs 6 kg and the energy consumption is 3 W. [46]

EFFECT OF GEOMAGNETIC GRADIENT ON MOTION OF CHARGED SATELLITE

Moscow IZVESTIYA VYSSHYKH UCHEBNYKH ZAVEDENIY, GEODEZIYA I AEROFOTOS"YEMKA in Russian No 6, 1976 pp 69-72

[Article by Yu. M. Manakov, Moscow Institute of Geodetic, Aerial Mapping and Cartographic Engineers, "Influence of Geomagnetic Field Gradient on the Motion of a Charged Artificial Earth Satellite"]

[Abstract] A study was made of the influence of the geomagnetic field gradient on the motion of charged artificial satellites. Equations are derived for the secular perturbations of artificial satellites caused by the effect exerted on a satellite having an orbital magnetic moment by a force dependent on the gradient of the earth's magnetic field. Equations are derived for taking into account the influence exerted on the satellite by the Lorentz force. The derived equations are used in computing and comparing the intensities of the perturbations acting on artificial earth satellites. [41]

LONG-PERIOD WIND SPEED FLUCTUATIONS AT 90-100 km

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian
Vol 13, No 1, 1977 pp 88-90

[Article by Yu. I. Portnyagin and L. V. Svetogorova, Institute of Experimental Meteorology, "Long-Period Fluctuations of Wind Speed in the Altitude Region 90-100 km and Their Correlation with Wave Processes in the Lower Atmosphere"]

[Abstract] Beginning in November 1972 specialists at the Institute of Experimental Meteorology began continuous measurements of wind speed at altitudes 90-100 km by the radar observation of meteor trails. This paper gives an analysis of some results of observations for the winter and summer seasons 1972-1973. For ascertaining the periodicities at different altitude levels a spectral analysis was made of the speed of the prevailing wind for altitudes 5, 10, 15, 20, 25 and 95 km. In winter for the zonal prevailing wind the main maximum at all altitudes was in the range 10-18 days. In summer in the spectra of the zonal component there are no clearly expressed periodicities common for all altitudes. A different picture is observed for the meridional speed of the prevailing wind. In both winter and summer the spectra of this component at all altitudes have a main maximum in winter with a period of about 21 days, and in summer with a period of about 16 days. The greatest transformation with transition from winter to summer is in the spectra for the meteor zone, especially for the zonal velocity of the zonal wind. In contrast to the zonal prevailing wind spectra, in the spectra for the meridional component in both winter and summer there are three principal periods; the summer maxima are displaced relative to the winter maxima in the direction of lesser periods. The article examines the behavior of the spectra of amplitudes of the semidiurnal tide in the meteor zone. The principal reason for the excitation of semidiurnal tidal variations is stratospheric ozone, which absorbs UV radiation and generates fluctuations propagating in the mesosphere and lower thermosphere. In the winter spectra of the tidal wind there is a main maximum of about 21 days for the meridional velocity of the prevailing wind and for both components of the semidiurnal tide. With transition from winter to summer the shift in the main maxima in the spectra of the prevailing wind is accompanied by a similar shift in the maxima of the spectral density of the tidal wind.

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MAGNETOSPHERIC LANGMUIR TURBULENCE AS RADIOEMISSION SOURCE

Moscow PIS'MA V ZHURNAL EKSPERIMENTAL'NOY I TEORETICHESKOY FIZIKI in Russian
Vol 24, Issue 10, 20 November 1976 pp 558-561

[Article by A. A. Galeev and V. V. Krasnosel'skikh, Space Research Institute, "Strong Langmuir Turbulence in Earth's Magnetosphere as Kilometer Radioemission Source"]

[Abstract] It is now clear that the source of nonthermal electromagnetic radiation is powerful fluxes of leaking electrons and electrical currents responsible for the transfer of the voltages arising at the boundary between the magnetosphere and the plasma into the conducting ionosphere of the planet. The transformation of the energy of the electron flux into the energy of electromagnetic waves does not occur directly but includes as an intermediate link the excitation of different kinds of plasma oscillations. It is found that the source of the earth's kilometer radioemission is strong Langmuir turbulence excited by a beam of electrons leaking from the tail of the earth's magnetosphere with the subsequent re-emission of their energy at a double plasma frequency. The determined efficiency of this transformation is capable of ensuring the observed effectiveness of the radiation.

[269]

DESCRIPTION OF CORE OF LUNAR GROUND FROM MARE CRISIUM

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 233, No 5, 1977 pp 928-931

[Article by A. V. Ivanov, M. A. Nazarov, O. D. Rode, Yu. I. Stakheyev, L. S. Tarasov, K. I. Tobelko and K. P. Florenskiy, Institute of Geochemistry and Analytical Chemistry, "Preliminary Description of Core of Lunar Ground from the Mare Crisium ("Luna-24")]

[Abstract] A sample of lunar ground was taken by the "Luna-24" in the southeastern part of the Mare Crisium on 18 August 1976. The sample was delivered to the Institute of Geochemistry and Analytical Chemistry in a sealed ampule and enclosed in a special chamber in a helium atmosphere. The elastic carrier, 262 cm long, filled with ground, was in the form of a cylindrical spiral. The returned material was nonuniform throughout the length of the column. It was easy to discriminate sectors of coarse-grained (1-2 mm) material, sectors containing fragments of relatively coarse (more than 5 mm) rock fragments, relatively uniform sectors of fine-grained material, and also sectors differing appreciably in reflectivity or the content of metallic iron. Study of the column made it possible to distinguish several zones within which 10-20 layers were later differentiated (a full page detailed diagram accompanies the text). At the top of the column there are large (from 1 to 6-8 mm) free particles of different rocks, underneath undergoing transition into ordinary fine-grained regolith; the thickness is about 10 cm. The next zone has a total thickness of about 60 cm and is made up of outwardly uniform regolith of a dark gray color with individual sectors of coarser-grained material. The underlying zone has a thickness of about 30 cm and is visually similar to the one above, but is characterized by a great quantity of coarsely fragmented material appearing nonuniformly in the entire depth of the zone and especially enriching its lower part. The deepest sector, with a total thickness of about 50 cm, is the lightest in color and the most stratified part of the regolith column.

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GEOMORPHOLOGICAL ANALYSIS OF "LUNA-24" LANDING REGION

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 233, No 5, 1977 pp 936-939

[Article by K. P. Florenskiy, A. T. Bazilevskiy and G. A. Burba, Institute of Geochemistry and Analytical Chemistry, "Geomorphological Analysis of the 'Luna-24' Station Landing Region"]

[Abstract] The "Luna-24" station delivered to the earth samples of lunar ground from the southeastern part of the Mare Crisium. The selected landing site was 40 km from the scarp of continental mountains and 18 km from Fahrenheit Crater (Piccard X) (a map of the region accompanies the text; there is also a hypsometric map of the landing region in this paper). It is shown that in the Mare Crisium basin there are up to four rings of highlands. The first of these, with a diameter of about 425 km, is traced in the coastal part of the plain. The second ring in the basin, with a diameter of about 500 km, is a system of block mountains bounding the plain of the Mare Crisium and rising 3-4 km above it. The third and fourth rings, with diameters of about 680 and 970 km, are less clearly expressed. The results of a photogeological mapping show that the material making up the Mare Crisium plain is rather uniform. With respect to general morphology, the surface of the Mare Crisium is similar to other lunar maria, this making it possible to consider it to be of basaltic composition, weakly reworked by processes of impact crater formation. The mean thickness of the regolith mantle is about 2 m, with probable variations from 1 to 10 m. Eighteen kilometers to the northeast, in the zone of a "deep" mascon-forming mare, is the Fahrenheit Crater with a diameter of 6.5 km and a depth of about 1.5 km. The absence of a ray system around the crater and the smoothed mesorelief of the wall make it possible to assign the time of its formation to the first half of the Copernican period.

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ELECTRON FLUXES MEASURED IN THE OPTICAL SHADOW OF VENUS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 232, No 5, 1977 pp 1039-1042

[Article by K. I. Gringauz, M. I. Verigin, T. K. Breus and T. Gomboshi, Space Research Institute USSR Academy of Sciences, "Electron Fluxes Measured in the Optical Shadow of Venus on the Satellites 'Venera-9, 10' as the Principal Ionization Source in the Venusian Nighttime Ionosphere"]

[Abstract] The "Venera-9" and "Venera-10" satellites were used in measuring the electron fluxes directed toward Venus at altitudes of about 1,500-2,000 km in the optical shadow of the planet. The electron energy spectra were registered using a wide-angle ($\pm 40^\circ$) sensor with analysis of electrons by energies with the feeding of 16 values of the retarding potential U_T

to the analyzing grid in the range 0-300 V. In the optical shadow of the planet the electron fluxes were always registered with all values of the retarding potential U_T . In the optical shadow most of the electrons have an energy of about tens of electron-volts. A formula is derived which makes it possible to obtain a quantitative estimate of the concentration of ionospheric electrons at the maximum of the nighttime ionosphere.

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VI. MISCELLANEOUS

News

PROSPECTS FOR INDUSTRIAL EXPLOITATION OF ANTARCTICA

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA in Russian No 6, 1976 pp 170-186

[Article by N. V. Vasil'chikov, Moscow State University, "Prospects for the Industrial Exploitation of Antarctica"]

[Abstract] The article first deals with background material on the Antarctic continent: solid surface, isolated position in the southern polar region of the planet, enormous reserves of fresh water (of first-class quality), absence of population, cold climate, singular structure of the shelf, high salinity of the waters washing Antarctica; circulation of air and water masses in the atmosphere and seas, potential reserves of minerals on the continent and resources of the sea floor and aseismicity of the Antarctic continent. The thrust of the article, however, is that the new technology now exists which makes exploitation of the continent feasible. It is noted that as mineral resources become more difficult to exploit elsewhere in the world, it becomes increasingly feasible to exploit minerals in Antarctica. This would be particularly true, for example, with respect to the exploitation of petroleum deposits on the shelf. Mineral exploitation on the southern continent will be aided by the development of new drilling technology, by the use of electrochemical methods for converting solid minerals into liquid or gaseous form, and by employing nuclear technology. Antarctica is an excellent site for nuclear power stations because of the vast quantities of water available; the heated water emanating from such plants could be first cooled by the glaciers before being dumped into the sea, thus excluding damage to marine life. Antarctica would be an ideal site for combined nuclear power plant-metallurgical plant installations. It would similarly be perfect for the production of power from cosmic helioelectric power stations, as well as for creating thermogradient electric power stations. It is strange that many are giving thought to man's practical use of space while leaving unexploited the vast potentialities of Antarctica. In actuality, the true conquest of Antarctica would contribute a vast wealth of experience which would be of value in some future exploitation of space. [384]